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THE AMERICAN EPHEMERIS AND NAUTICAL ALMANAC

FOR THE YEAR 1967

WASHINGTON

Issued by the
Nautical Almanac Office
United States
Naval Observatory
by direction of the
Secretary of the Navy
and under the
authority of Congress

LONDON

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The Astronomical Ephemeris



U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1965

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THE AMERICAN EPHEMERIS AND NAUTICAL ALMANAC

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THE ASTRONOMICAL EPHEMERIS

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PREFACE

With the editions for 1960, *The American Ephemeris and Nautical Almanac* issued by the Nautical Almanac Office, United States Naval Observatory, and *The Astronomical Ephemeris* issued by H. M. Nautical Almanac Office, Royal Greenwich Observatory, were unified. With the exception of the introductory pages i, ii and vi onwards, the two publications are identical; they are printed separately in the two countries, from reproducible material prepared partly in the United States of America and partly in the United Kingdom.

The title *The Astronomical Ephemeris* replaced, without loss of continuity of content, the previous title of *The Nautical Almanac and Astronomical Ephemeris* (usually abbreviated to *The Nautical Almanac*), which was introduced by Nevil Maskelyne for the original British edition of 1767; the title *The Nautical Almanac* is now used, in both the United Kingdom and the United States, for the unified edition of the Almanacs for surface navigation previously entitled *The Abridged Nautical Almanac* and *The American Nautical Almanac* respectively.

The unification did not require any substantial changes in either publication; but a number of revisions have been made to increase the precision and improve the usefulness. The contents are fully described in the *Explanation* at the end of the volume. The principal changes from the immediately preceding volumes are for the purpose of conforming to the recommendations of the Paris Conference on Astronomical Constants in 1950 and to the resolutions of the International Astronomical Union at the Zürich Assembly in 1948, the Rome Assembly in 1952, and the Dublin Assembly in 1955. These changes are described in the *Preface* to the volume for 1960. A few small changes have been introduced since 1960, but none have been made since the edition for 1966.

Although no data are now included in respect of occultations of stars by the Moon, the occultation programme of H. M. Nautical Almanac Office continues unchanged. Arrangements for the publication of predictions have been made as follows: for stations in the United States and Canada in *Sky and Telescope*; and for other Commonwealth stations in *The Handbook of the British Astronomical Association*. Machine copies of predictions for any of the stations for which predictions are made may be obtained from H. M. Nautical Almanac Office, on request.

The apparent places of the 1535 stars in the FK4 are available in *Apparent Places of Fundamental Stars*, published annually under the auspices of the International Astronomical Union, by the Astronomisches Rechen-Institut in Heidelberg. The apparent places of the 1483 stars with declinations in the range -81° to $+81^{\circ}$ are tabulated continuously at intervals of ten upper transits at Greenwich; those of the 52 circumpolar stars, including *Polaris*, are given for every upper transit at Greenwich. Each volume also contains, for purposes of record, the Besselian Day Numbers at 12^h Greenwich sidereal time, without short-period terms, with which the apparent places of the 10-day stars are calculated. A separate list of mean places for the equinox of 1965.0 was published with the edition for 1965.

The star ephemerides that are needed by surveyors, including the tables relating to *Polaris*, are available in *The Ephemeris* prepared by the Nautical Almanac Office,

United States Naval Observatory and published by the U.S. Bureau of Land Management, and in *The Star Almanac for Land Surveyors* prepared by H. M. Nautical Almanac Office, Royal Greenwich Observatory and published by H. M. Stationery Office.

An *Explanatory Supplement* to the edition of this volume for 1960 (H. M. Stationery Office, London, 1961, reprinted 1962, price 42s.) contains detailed explanations of the data, together with a derivation and numerical illustrations, as well as useful permanent tables that are now omitted.

By international agreement, the basic calculations for this volume, and for other astronomical ephemerides such as *Apparent Places of Fundamental Stars*, and *Ephemerides of Minor Planets*, are shared between the ephemeris offices of a number of countries. Contributions, in addition to those listed below, are made by the Astronomisches Rechen-Institut in Heidelberg, the Institute for Theoretical Astronomy in Leningrad, and the offices of the *Connaissance des Temps* in Paris and the *Efemerides Astronómicas* in San Fernando.

The ephemeris of Universal and Sidereal Times, the ephemerides of the Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune, the geocentric ephemerides of Ceres, Pallas, Juno, Vesta, and Pluto, the nutation in longitude and obliquity, the Day Numbers, and the Phenomena, are prepared in H. M. Nautical Almanac Office.

The conjunctions and phenomena of Satellites I–IV of Jupiter and the diagrams of the configurations are received from the office of the *Connaissance des Temps*. The data for forming Table II are received from the Astronomisches Rechen-Institut.

The remaining data in the volume are prepared in the Nautical Almanac Office, United States Naval Observatory, namely: mean places of stars; eclipses of the Sun and Moon; ephemerides for physical observations of the Sun, Moon, and planets; ephemerides of the satellites of Mars, Saturn, Uranus, and Neptune, and of Satellites V, VI, and VII of Jupiter, and of the rings of Saturn; local mean times of moonrise and moonset; Tables III, IV, and VI.

This volume was prepared jointly by H. M. Nautical Almanac Office, Royal Greenwich Observatory, under the immediate supervision of D. H. Sadler, and by the Nautical Almanac Office, United States Naval Observatory, under the immediate supervision of Raynor L. Duncombe and Ralph F. Haupt.

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R. v.d. R. WOOLLEY,
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England

December, 1964

The British edition of this publication is the two-hundredth anniversary edition of the ephemeris first published for the year 1767 under the title *The Nautical Almanac and Astronomical Ephemeris*. Although the logical successor to that primarily nautical ephemeris is *The Nautical Almanac*, *The Astronomical Ephemeris* is also in direct line of descent both in regard to content and title. To mark this occasion there is included, in the British Edition, a short account of the contents of the first edition and of its subsequent development.

A similar account is given in the British Edition of *The Nautical Almanac* for 1967; and a separate publication "A Modern View of Lunar Distances" contains calculated lunar distances for a series of dates in February 1967 together with a comprehensive illustration of their use. A copy will be sent on receipt of a request addressed to the Superintendent, U.S. Naval Observatory, Washington, D.C., 20390.

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The calculations for the principal ephemerides prepared in the Nautical Almanac Office, United States Naval Observatory, were made by the following members of the staff and their assistants: eclipses of the Sun and the Moon, SIMONE DARO GOSSNER; ephemerides for physical observations of the Sun, Moon, and planets, and ephemerides of the satellites of Mars, Saturn, Uranus, and Neptune, satellites VI and VII of Jupiter, and the rings of Saturn, CHARLOTTE KRAMPE; local mean time of moonrise and moonset, RALPH F. HAUPT and ARMSTRONG THOMAS. The editing and proofreading of these data are performed under the supervision of BERENICE L. MORRISON.

ΔT

REDUCTION FROM UNIVERSAL TIME TO EPHEMERIS TIME

Add to Universal Time

	s	d		s	d		s	d
1901.5	- 2.54	-.000029	1926.5	+22.72	+.000263	1951.5	+29.66	+.000343
1902.5	- 1.13	-.000013	1927.5	22.82	.000264	1952.5	30.29	.000351
1903.5	+ 0.35	+.000004	1928.5	22.92	.000265	1953.5	30.96	.000358
1904.5	1.80	.000021	1929.5	23.05	.000267	1954.5	31.09	.000360
1905.5	3.26	.000038	1930.5	23.18	.000268	1955.5	31.59	.000366
1906.5	+ 4.69	+.000054	1931.5	+23.34	+.000270	1956.5	+32.06	+ .000371
1907.5	6.11	.000071	1932.5	23.50	.000272	1957.5	31.82	.000368
1908.5	7.51	.000087	1933.5	23.60	.000273	1958.5	32.69	.000378
1909.5	8.90	.000103	1934.5	23.64	.000274	1959.5	33.05	.000383
1910.5	10.28	.000119	1935.5	23.63	.000273	1960.5	33.16	.000384
1911.5	+11.64	+.000135	1936.5	+23.58	+.000273	1961.5	+33.59	+.000389
1912.5	12.95	.000150	1937.5	23.63	.000273	1962.5	34.08	.000394
1913.5	14.18	.000164	1938.5	23.76	.000275	1963.5	34.2	.00040
1914.5	15.31	.000177	1939.5	23.99	.000278	1964.5	35	. . .
1915.5	16.39	.000190	1940.5	24.30	.000281	1965.5	35	. . .
1916.5	+17.37	+.000201	1941.5	+24.71	+.000286	1966.5	+36	. . .
1917.5	18.27	.000211	1942.5	25.15	.000291	1967.5	36	. . .
1918.5	19.08	.000221	1943.5	25.61	.000296	1968.5		
1919.5	19.83	.000230	1944.5	26.08	.000302	1969.5		
1920.5	20.48	.000237	1945.5	26.57	.000308	1970.5		
1921.5	+21.06	+.000244	1946.5	+27.08	+.000313	1971.5		
1922.5	21.56	.000250	1947.5	27.61	.000320	1972.5		
1923.5	21.97	.000254	1948.5	28.15	.000326	1973.5		
1924.5	22.29	.000258	1949.5	28.94	.000335	1974.5		
1925.5	+22.55	+.000261	1950.5	+29.42	+.000341	1975.5		

The values given to whole seconds are extrapolated; those given to 0^h1 are provisional values based on incomplete observational data. The values given to 0^h01 are based on more extensive data; small corrections are sometimes applied when further data become available, but in general they may be considered practically final.

The values previous to 1949.5 are those of BROUWER, *Astronomical Journal*, 57, 133, 1952; his table of ΔT extends over most of the 19th century.

CIVIL CALENDAR

New Year's Day	Sun.	Jan. 1	Labor Day	Mon.	Sept. 4
Lincoln's Birthday	Sun.	Feb. 12	Columbus Day	Thu.	Oct. 12
Washington's Birthday	Wed.	Feb. 22	Election Day	Tue.	Nov. 7
Memorial Day	Tue.	May 30	Veterans Day	Sat.	Nov. 11
Independence Day	Tue.	July 4	Thanksgiving Day	Thu.	Nov. 23

ADDITIONS

The American Ephemeris

Values of the orbital eccentricity of Rhea were omitted from 1961–1965

1961	$e=0.00115$	Apr. 1–May 5	1962	$e=0.00111$	Apr. 6
	$=0.00114$	May 6–July 30		$=0.00110$	Apr. 7–June 25
	$=0.00113$	July 31–Oct. 23		$=0.00109$	June 26–Sept. 12
	$=0.00112$	Oct. 24–Nov. 17		$=0.00108$	Sept. 13–Nov. 22
1963	$e=0.00106$	Apr. 21–May 1	1964	$e=0.00101$	May 5–May 8
	$=0.00105$	May 2–July 15		$=0.00100$	May 9–July 20
	$=0.00104$	July 16–Sept. 28		$=0.00099$	July 21–Oct. 2
	$=0.00103$	Sept. 29–Dec. 7		$=0.00098$	Oct. 3–Dec. 14
				$=0.00097$	Dec. 15–Dec. 21
			1965	$e=0.00096$	May 10
				$=0.00095$	May 11–July 23
				$=0.00094$	July 24–Oct. 5
				$=0.00093$	Oct. 6–Dec. 19
				$=0.00092$	Dec. 20–Dec. 26

CORRECTIONS

The American Ephemeris, 1963, 1964, 1965, 1966

page 499 in 1963, page 500 in 1964

page 502 in 1965, page 490 in 1966

In the equation for *magnitude of greatest partial eclipse*
for 0.5459 read 0.5464

and in the equation for *magnitude of the central phase*
for 0.5459 read 0.5464

The American Ephemeris, 1965

Page

378 Titan, e , multiply all values by 0.1

Explanatory Supplement to the Astronomical Ephemeris and the American Ephemeris and Nautical Almanac (First Edition)

- 18 Volume XVI. For 1959 read 1958
- 37 For $\omega_0 = \omega - b \sin (\Omega + c')$ cosec read $\omega_0 = \omega - b \sin (\Omega + c')$ cosec i
- 38 For $c = 180^\circ - \Pi_m - \frac{1}{2}a$ read $c = 180^\circ - \Pi_m + \frac{1}{2}a$
- For $c' = 180^\circ - \Pi_m + \frac{1}{2}a$ read $c' = 180^\circ - \Pi_m - \frac{1}{2}a$
- 95 Line 22. For B.2. read B.1.
- 98 Mean anomaly—the second expression for g requires an equals sign.
- 115 Mean elements of the outer planets. Jupiter, L , 1960 Jan. 1.5.
For $259^\circ 48' 52''.05$ read $259^\circ 49' 52''.05$
- 264 Example 9.24. After $\Delta L = -0''.90$ insert
together with $\Delta \log_{10} r = +0.0000$ 026 instead of $\Delta \log_{10} r = +0.0000$ 011
- 367 Figure 12.6. For S Geocentric read S Planetocentric
- 396 Kuiper, 1956. For I read 2
- 442 Line 12. For Earth read equinox
- 459 Line 14. For *Achstellige* read *Achtstellige*
- 470 Table 16.3. Maximum differences in the fundamental ephemerides
SUN Rectangular coordinates (X, Y, Z) for $\delta^4 = 2$ read $\delta^4 = 12$
- NUTATION in obliquity for $\begin{smallmatrix} \delta^2 & \delta^3 & \delta^4 \end{smallmatrix}$ 82 32 20 read $\begin{smallmatrix} \delta^2 & \delta^3 & \delta^4 \end{smallmatrix}$ 32 20 15
- MOON Ephemeris transit for 160 20 10 read 270 95 30
- 491 Dimensions and rotations of the planets Add to footnote:
The tabulated semi-diameters are the values adopted in the Ephemeris.

CHRONOLOGICAL CYCLES AND ERAS

Dominical Letter	...	...	A	Julian Period (year of)	...	6680
Epact	...	...	19	Roman Indiction	...	5
Golden Number (Lunar Cycle)			XI	Solar Cycle	...	16

All dates are given in terms of the Gregorian calendar.

January 14 corresponds to January 1, Julian reckoning.

Julian Day 243 9492 begins at Greenwich mean noon on January 1.

ERA	YEAR	BEGINS	ERA	YEAR	BEGINS
Byzantine	...	7476 Sept. 14	Grecian	...	2279 Sept. 14
Jewish (A. M.)	...	5728 Oct. 5	(Seleucidæ)	...	(or Oct. 14)
Roman (A.U.C.)	...	2720 Jan. 14	Indian (Saka)	...	1889 Mar. 22
Nabonassar	...	2716 May 2	Diocletian	...	1684 Sept. 12
Japanese	...	2627 Jan. 1	Mohammedan	...	1387 Apr. 11
			(Hegira)		

RELIGIOUS CALENDARS

Epiphany	...	Jan. 6	Rogation Sunday	...	Apr. 30
Septuagesima Sunday	...	Jan. 22	Ascension Day—		
Quinquagesima (Shrove)			Holy Thursday	...	May 4
Sunday	...	Feb. 5	Whit Sunday—Pentecost	...	May 14
Ash Wednesday	...	Feb. 8	Trinity Sunday	...	May 21
Palm Sunday	...	Mar. 19	Corpus Christi	...	May 25
Good Friday	...	Mar. 24	First Sunday in Advent	...	Dec. 3
Easter Day	...	Mar. 26	Christmas Day (Monday)	...	Dec. 25
First day of Passover (Pesach)	...	Apr. 25	Day of Atonement		
Feast of Weeks (Shebuoth)	...	June 14	(Yom Kippur)	...	Oct. 14
Jewish New Year (tabular)			First day of Tabernacles		
(Rosh Hashanah)	...	Oct. 5	(Succoth)	...	Oct. 19
Mohammedan New Year	...	Apr. 11	First day of Ramadân	...	Dec. 3
(tabular)			(tabular)		

Day of Month	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date
		2439		2439		2439		2439		2439		2439
1.0	S.	491.5	W.	522.5	W.	550.5	S.	581.5	M.	611.5	Th.	642.5
2.0	M.	492.5	Th.	523.5	Th.	551.5	S.	582.5	Tu.	612.5	F.	643.5
3.0	Tu.	493.5	F.	524.5	F.	552.5	M.	583.5	W.	613.5	S.	644.5
4.0	W.	494.5	S.	525.5	S.	553.5	Tu.	584.5	Th.	614.5	S.	645.5
5.0	Th.	495.5	S.	526.5	S.	554.5	W.	585.5	F.	615.5	M.	646.5
6.0	F.	496.5	M.	527.5	M.	555.5	Th.	586.5	S.	616.5	Tu.	647.5
7.0	S.	497.5	Tu.	528.5	Tu.	556.5	F.	587.5	S.	617.5	W.	648.5
8.0	S.	498.5	W.	529.5	W.	557.5	S.	588.5	M.	618.5	Th.	649.5
9.0	M.	499.5	Th.	530.5	Th.	558.5	S.	589.5	Tu.	619.5	F.	650.5
10.0	Tu.	500.5	F.	531.5	F.	559.5	M.	590.5	W.	620.5	S.	651.5
11.0	W.	501.5	S.	532.5	S.	560.5	Tu.	591.5	Th.	621.5	S.	652.5
12.0	Th.	502.5	S.	533.5	S.	561.5	W.	592.5	F.	622.5	M.	653.5
13.0	F.	503.5	M.	534.5	M.	562.5	Th.	593.5	S.	623.5	Tu.	654.5
14.0	S.	504.5	Tu.	535.5	Tu.	563.5	F.	594.5	S.	624.5	W.	655.5
15.0	S.	505.5	W.	536.5	W.	564.5	S.	595.5	M.	625.5	Th.	656.5
16.0	M.	506.5	Th.	537.5	Th.	565.5	S.	596.5	Tu.	626.5	F.	657.5
17.0	Tu.	507.5	F.	538.5	F.	566.5	M.	597.5	W.	627.5	S.	658.5
18.0	W.	508.5	S.	539.5	S.	567.5	Tu.	598.5	Th.	628.5	S.	659.5
19.0	Th.	509.5	S.	540.5	S.	568.5	W.	599.5	F.	629.5	M.	660.5
20.0	F.	510.5	M.	541.5	M.	569.5	Th.	600.5	S.	630.5	Tu.	661.5
21.0	S.	511.5	Tu.	542.5	Tu.	570.5	F.	601.5	S.	631.5	W.	662.5
22.0	S.	512.5	W.	543.5	W.	571.5	S.	602.5	M.	632.5	Th.	663.5
23.0	M.	513.5	Th.	544.5	Th.	572.5	S.	603.5	Tu.	633.5	F.	664.5
24.0	Tu.	514.5	F.	545.5	F.	573.5	M.	604.5	W.	634.5	S.	665.5
25.0	W.	515.5	S.	546.5	S.	574.5	Tu.	605.5	Th.	635.5	S.	666.5
26.0	Th.	516.5	S.	547.5	S.	575.5	W.	606.5	F.	636.5	M.	667.5
27.0	F.	517.5	M.	548.5	M.	576.5	Th.	607.5	S.	637.5	Tu.	668.5
28.0	S.	518.5	Tu.	549.5	Tu.	577.5	F.	608.5	S.	638.5	W.	669.5
29.0	S.	519.5			W.	578.5	S.	609.5	M.	639.5	Th.	670.5
30.0	M.	520.5			Th.	579.5	S.	610.5	Tu.	640.5	F.	671.5
31.0	Tu.	521.5			F.	580.5			W.	641.5		

The Julian Day begins at noon.

The fraction of the year, τ , measured from the beginning of the Besselian solar year, is given on pages 258–272. For the first half of the year, on pages 258–264, it is measured from 1967.0 or 1967 January 1^d.041; for the second half of the year, on pages 266–272, it is measured from 1968.0 or 1968 January 1^d.283.

Day of Month	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date	Day of Week	Julian Date
1-0	S.	2439 672.5	Tu.	2439 703.5	F.	2439 734.5	\$.	2439 764.5	W.	2439 795.5	F.	2439 825.5
2-0	\$.	673.5	W.	704.5	S.	735.5	M.	765.5	Th.	796.5	S.	826.5
3-0	M.	674.5	Th.	705.5	\$.	736.5	Tu.	766.5	F.	797.5	\$.	827.5
4-0	Tu.	675.5	F.	706.5	M.	737.5	W.	767.5	S.	798.5	M.	828.5
5-0	W.	676.5	S.	707.5	Tu.	738.5	Th.	768.5	\$.	799.5	Tu.	829.5
6-0	Th.	677.5	\$.	708.5	W.	739.5	F.	769.5	M.	800.5	W.	830.5
7-0	F.	678.5	M.	709.5	Th.	740.5	S.	770.5	Tu.	801.5	Th.	831.5
8-0	S.	679.5	Tu.	710.5	F.	741.5	\$.	771.5	W.	802.5	F.	832.5
9-0	\$.	680.5	W.	711.5	S.	742.5	M.	772.5	Th.	803.5	S.	833.5
10-0	M.	681.5	Th.	712.5	\$.	743.5	Tu.	773.5	F.	804.5	\$.	834.5
11-0	Tu.	682.5	F.	713.5	M.	744.5	W.	774.5	S.	805.5	M.	835.5
12-0	W.	683.5	S.	714.5	Tu.	745.5	Th.	775.5	\$.	806.5	Tu.	836.5
13-0	Th.	684.5	\$.	715.5	W.	746.5	F.	776.5	M.	807.5	W.	837.5
14-0	F.	685.5	M.	716.5	Th.	747.5	S.	777.5	Tu.	808.5	Th.	838.5
15-0	S.	686.5	Tu.	717.5	F.	748.5	\$.	778.5	W.	809.5	F.	839.5
16-0	\$.	687.5	W.	718.5	S.	749.5	M.	779.5	Th.	810.5	S.	840.5
17-0	M.	688.5	Th.	719.5	\$.	750.5	Tu.	780.5	F.	811.5	\$.	841.5
18-0	Tu.	689.5	F.	720.5	M.	751.5	W.	781.5	S.	812.5	M.	842.5
19-0	W.	690.5	S.	721.5	Tu.	752.5	Th.	782.5	\$.	813.5	Tu.	843.5
20-0	Th.	691.5	\$.	722.5	W.	753.5	F.	783.5	M.	814.5	W.	844.5
21-0	F.	692.5	M.	723.5	Th.	754.5	S.	784.5	Tu.	815.5	Th.	845.5
22-0	S.	693.5	Tu.	724.5	F.	755.5	\$.	785.5	W.	816.5	F.	846.5
23-0	\$.	694.5	W.	725.5	S.	756.5	M.	786.5	Th.	817.5	S.	847.5
24-0	M.	695.5	Th.	726.5	\$.	757.5	Tu.	787.5	F.	818.5	\$.	848.5
25-0	Tu.	696.5	F.	727.5	M.	758.5	W.	788.5	S.	819.5	M.	849.5
26-0	W.	697.5	S.	728.5	Tu.	759.5	Th.	789.5	\$.	820.5	Tu.	850.5
27-0	Th.	698.5	\$.	729.5	W.	760.5	F.	790.5	M.	821.5	W.	851.5
28-0	F.	699.5	M.	730.5	Th.	761.5	S.	791.5	Tu.	822.5	Th.	852.5
29-0	S.	700.5	Tu.	731.5	F.	762.5	\$.	792.5	W.	823.5	F.	853.5
30-0	\$.	701.5	W.	732.5	S.	763.5	M.	793.5	Th.	824.5	S.	854.5
31-0	M.	702.5	Th.	733.5			Tu.	794.5			\$.	855.5

The Julian Day begins at noon.

The fraction of the year, τ , measured from the beginning of the Besselian solar year, is given on pages 258-272. For the first half of the year, on pages 258-264, it is measured from 1967.0 or 1967 January 1^d.041; for the second half of the year, on pages 266-272, it is measured from 1968.0 or 1968 January 1^d.283.

PHENOMENA, 1967

GEOCENTRIC PHENOMENA IN UNIVERSAL TIME

MERCURY

Superior conjunction	... Jan. 18 02	May 11 16	Aug. 24 16	Dec. 28 23
Greatest elongation East	Feb. 16 16 (18°)	June 12 10 (24°)	Oct. 9 04 (25°)	
Stationary	... Feb. 22 14	June 25 17	Oct. 21 10	
Inferior conjunction	... Mar. 4 08	July 9 12	Nov. 1 15	
Stationary	... Mar. 16 16	July 20 08	Nov. 10 09	
Greatest elongation West	Mar. 31 16 (28°)	July 30 03 (20°)	Nov. 17 21 (19°)	

VENUS

Greatest elongation East	June 21 00 (45°)	Stationary ...	Sept. 18 20
Greatest brilliancy	July 24 10	Greatest brilliancy	Oct. 6 02
Stationary	Aug. 6 06	Greatest elongation West	Nov. 9 15 (47°)
Inferior conjunction	Aug. 29 22		

EARTH

Perihelion	Jan. 2	Equinoxes	Mar. 21 07 37	Sept. 23 17 38
Aphelion	July 5	Solstices	June 22 02 23	Dec. 22 13 17

SUPERIOR PLANETS

	Stationary	Opposition	Stationary	Conjunction
Mars	Mar. 8 19	Apr. 15 12	May 27 15	—
Jupiter	Dec. 22 23	Jan. 20 05	Mar. 21 09	Aug. 8 19
Saturn	July 26 08	Oct. 2 22	Dec. 10 10	Mar. 23 19
Uranus	—	Mar. 13 16	May 29 06	Sept. 18 10
Neptune	Feb. 25 08	May 14 12	Aug. 4 04	Nov. 17 03
Pluto	—	Mar. 10 15	June 4 23	Sept. 13 23

HELIOCENTRIC PHENOMENA

	Perihelion	Aphelion	Ascending Node	Greatest Lat. North	Descending Node	Greatest Lat. South
Mercury	—	Jan. 3	—	—	—	Jan. 24
	Feb. 16	Apr. 1	Feb. 12	Feb. 27	Mar. 22	Apr. 22
	May 15	June 28	May 11	May 26	June 18	July 19
	Aug. 11	Sept. 24	Aug. 7	Aug. 22	Sept. 14	Oct. 15
	Nov. 7	Dec. 21	Nov. 3	Nov. 18	Dec. 11	—
Venus	—	Jan. 1	—	—	—	Jan. 23
	Apr. 23	Aug. 14	Mar. 21	May 15	July 10	Sept. 5
	Dec. 4	—	Oct. 31	Dec. 26	—	—
Mars	Dec. 4	—	—	—	June 4	Nov. 9

Jupiter, Saturn, Uranus, Neptune, Pluto: None in 1967

ECLIPSES

Total eclipse of the Moon, Apr. 24	The Americas, Asia, Australasia
Partial eclipse of the Sun, May 9	North America, North Pole, Northern Europe
Total eclipse of the Moon, Oct. 18	The Americas, Asia, Australasia
*Total eclipse of the Sun, Nov. 2	South Africa, Antarctica

* The axis of the shadow does not touch the Earth.

OCCULTATIONS OF PLANETS AND BRIGHT STARS

Date	Body	Area of Visibility	Date	Body	Area of Visibility
Jan. ^{d h} 3 19	Mars	E. Asia, Pacific	July ^{d h} 27 14	Saturn	N.E. Asia, N.W. America
31 21	Mars	Antarctica			
Mar. 13 21	Venus	S. America	Aug. 12 08	Mars	Asia, N. Australia
Apr. 8 15	Saturn	S. America	23 20	Saturn	E. Europe, N.W. Asia
13 06	Venus	N.E. Europe, Asia	Sept. 9 21	Mars	Antarctica
23 17	Mars	Cent. and E. Africa, S. Australia	10 12	<i>Antares</i>	N. Asia
			20 00	Saturn	Greenland, Iceland
May 6 04	Saturn	S.E. Asia, Indonesia, W. and N. Australia	Oct. 7 20	<i>Antares</i>	N.E. America
			17 02	Saturn	N. and Cent. America
June 2 17	Saturn	New Zealand, Pacific, N. and Cent. America	Nov. 4 05	<i>Antares</i>	N. and E. Asia
30 04	Saturn	N. and W. Africa, S. and E. Europe, Asia	13 04	Saturn	N. America
			Dec. 10 10	Saturn	Asia, Alaska
			29 03	<i>Antares</i>	Asia

DIARY

Jan. ^{d h} 1 10	Moon at perigee		Feb. ^{d h} 22 14	Mercury stationary	
2 05	Uranus 3° S. of Moon		23 12	Venus 1°·1 N. of Saturn	
3 14	LAST QUARTER		24 18	FULL MOON	
3 19	Mars 0°·4 S. of Moon	Occ ⁿ .	25 08	Neptune stationary	
6 15	Neptune 3° N. of Moon		25 20	Uranus 3° S. of Moon	
10 18	NEW MOON		25 21	Moon at perigee	
12 00	Venus 4° N. of Moon		28 15	Mars 2° N. of Moon	
15 23	Saturn 2° N. of Moon		Mar. 2 03	Neptune 3° N. of Moon	
16 21	Moon at apogee		3 09	LAST QUARTER	
18 02	Mercury in superior conjunction		4 08	Mercury in inferior conjunction	
18 08	Mars 5° N. of <i>Spica</i>		6 16	Juno stationary	
18 20	FIRST QUARTER		8 19	Mars stationary	
20 05	Jupiter at opposition		9 22	Mercury 8° N. of Moon	
25 18	Jupiter 4° S. of Moon		10 15	Pluto at opposition	
26 07	FULL MOON		11 04	NEW MOON	
27 04	Juno at opposition		13 01	Moon at apogee	
28 15	Moon at perigee		13 16	Uranus at opposition	
29 12	Uranus 3° S. of Moon		13 21	Venus 1° N. of Moon	Occ ⁿ .
31 21	Mars 1° N. of Moon	Occ ⁿ .	16 16	Mercury stationary	
Feb. 1 23	LAST QUARTER		19 09	FIRST QUARTER	
2 21	Neptune 3° N. of Moon		21 07	Jupiter 5° S. of Moon	
8 08	Ceres stationary		21 08	Equinox	
9 11	NEW MOON		21 09	Jupiter stationary	
10 18	Mercury 5° N. of Moon		23 19	Saturn in conjunction with Sun	
11 09	Venus 3° N. of Moon		25 05	Uranus 3° S. of Moon	
12 13	Saturn 1° N. of Moon		26 03	FULL MOON	
13 15	Moon at apogee		26 08	Moon at perigee	
16 16	Mercury greatest elong. E. (18°)		27 22	Mars 2° N. of Moon	
17 16	FIRST QUARTER		29 12	Neptune 3° N. of Moon	
21 23	Jupiter 4° S. of Moon		31 16	Mercury greatest elong. W. (28°)	

Apr.	d h			June	d h		
	1 21	LAST QUARTER			11 22	Venus 3° S. of Moon	
	4 22'	Vesta stationary			12 10	Mercury greatest elong. E. (24°)	
	7 09	Mercury 2° N. of Moon			15 03	Uranus 3° S. of Moon	
	8 15	Saturn 0°·8 N. of Moon	Occ ⁿ		15 11	FIRST QUARTER	
	9 03	Moon at apogee			17 03	Mars 2° S. of Moon	
	9 22	NEW MOON			18 20	Moon at perigee	
	13 06	Venus 0°·8 S. of Moon	Occ ⁿ .		19 15	Neptune 3° N. of Moon	
	15 12	Mars at opposition			21 00	Venus greatest elong. E. (45°)	
	17 16	Jupiter 5° S. of Moon			22 02	Solstice	
	17 21	FIRST QUARTER			22 05	FULL MOON	
	18 03	Mercury 0°·5 S. of Saturn			25 17	Mercury stationary	
	21 14	Uranus 3° S. of Moon			29 19	LAST QUARTER	
	21 18	Mars nearest to Earth			30 04	Saturn 0°·4 S. of Moon	Occ ⁿ .
	23 06	Venus 7° N. of <i>Aldebaran</i>			30 20	Moon at apogee	
	23 07	Mars 4° N. of <i>Spica</i>		July	1 05	Vesta stationary	
	23 17	Mars 0°·4 N. of Moon	Occ ⁿ .		3 07	Mars 1°·4 N. of <i>Spica</i>	
	23 19	Moon at perigee			7 17	NEW MOON	
	24 12	FULL MOON	Eclipse		8 05	Venus 0°·2 S. of <i>Regulus</i>	
	25 21	Neptune 3° N. of Moon			9 10	Jupiter 5° S. of Moon	
May	1 11	LAST QUARTER			9 12	Mercury in inferior conjunction	
	6 04	Saturn 0°·5 N. of Moon	Occ ⁿ .		11 00	Venus 5° S. of Moon	
	6 11	Moon at apogee			12 10	Uranus 3° S. of Moon	
	9 15	NEW MOON	Eclipse		14 16	FIRST QUARTER	
	11 16	Mercury in superior conjunction			14 20	Moon at perigee	
	13 07	Venus 2° S. of Moon			15 01	Mars 2° S. of Moon	
	14 12	Neptune at opposition			16 21	Neptune 4° N. of Moon	
	15 04	Jupiter 5° S. of Moon			20 08	Mercury stationary	
	15 21	Vesta at opposition			21 15	FULL MOON	
	17 05	FIRST QUARTER			24 10	Venus at greatest brilliancy	
	18 21	Uranus 3° S. of Moon			26 08	Saturn stationary	
	20 16	Mars 2° S. of Moon			27 14	Saturn 0°·9 S. of Moon	Occ ⁿ .
	21 01	Mercury 7° N. of <i>Aldebaran</i>			28 14	Moon at apogee	
	22 02	Moon at perigee			29 12	LAST QUARTER	
	23 07	Neptune 3° N. of Moon		Aug.	30 03	Mercury greatest elong. W. (20°)	
	23 20	FULL MOON			4 04	Neptune stationary	
	27 15	Mars stationary			4 15	Mercury 6° S. of Moon	
	29 06	Uranus stationary			5 04	Mercury 7° S. of <i>Pollux</i>	
	31 02	LAST QUARTER			6 03	NEW MOON	
June	31 13	Venus 4° S. of <i>Pollux</i>			6 06	Venus stationary	
	2 17	Saturn 0°·1 N. of Moon	Occ ⁿ .		8 01	Venus 10° S. of Moon	
	3 02	Moon at apogee			8 19	Jupiter in conjunction with Sun	
	4 23	Pluto stationary			8 19	Uranus 3° S. of Moon	
	8 04	Pallas in conjunction with Sun			9 15	Moon at perigee	
	8 05	NEW MOON			12 08	Mars 0°·4 S. of Moon	Occ ⁿ .
	9 02	Venus 1°·8 N. of Jupiter			12 21	FIRST QUARTER	
	10 05	Mercury 3° S. of Moon			13 02	Neptune 4° N. of Moon	
	11 17	Jupiter 5° S. of Moon			20 02	FULL MOON	

Aug.	d h		Oct.	d h	
	23 12	Ceres in conjunction with Sun		26 12	LAST QUARTER
	23 20	Saturn 1° S. of Moon Occ ⁿ .		28 13	Jupiter 4° S. of Moon
	24 16	Mercury in superior conjunction		29 20	Venus 4° S. of Moon
	25 09	Moon at apogee		30 10	Uranus 2° S. of Moon
	28 06	LAST QUARTER	Nov.	1 15	Mercury in inferior conjunction
	29 13	Mars 3° S. of Neptune		2 02	Moon at perigee
	29 22	Venus in inferior conjunction		2 06	NEW MOON Eclipse
Sept.	3 00	Jupiter 4° S. of Moon		3 06	Neptune 4° N. of Moon
	4 00	Venus 10° S. of <i>Regulus</i>		4 05	<i>Antares</i> 1° S. of Moon Occ ⁿ .
	4 12	NEW MOON		6 09	Mars 3° N. of Moon
	6 03	Mercury $0^{\circ}.3$ N. of Uranus		7 10	Venus $0^{\circ}.1$ S. of Uranus
	6 08	Moon at perigee		9 01	FIRST QUARTER
	9 09	Neptune 4° N. of Moon		9 15	Venus greatest elong. W. (47°)
	9 21	Mars 1° N. of Moon Occ ⁿ .		10 09	Mercury stationary
	10 12	<i>Antares</i> 1° S. of Moon Occ ⁿ .		13 04	Saturn $0^{\circ}.8$ S. of Moon Occ ⁿ .
	11 03	FIRST QUARTER		15 08	Moon at apogee
	13 23	Pluto in conjunction with Sun		17 03	Neptune in conjunction with Sun
	18 10	Uranus in conjunction with Sun		17 05	FULL MOON
	18 17	FULL MOON		17 21	Mercury greatest elong. W. (19°)
	18 20	Venus stationary		25 00	LAST QUARTER
	20 00	Saturn 1° S. of Moon Occ ⁿ .		25 03	Jupiter 4° S. of Moon
	22 00	Moon at apogee		26 21	Uranus 2° S. of Moon
	23 07	Mars 3° N. of <i>Antares</i>		28 11	Venus 2° N. of Moon
	23 18	Equinox		30 01	Venus 5° N. of <i>Spica</i>
	24 21	Mercury $0^{\circ}.8$ N. of <i>Spica</i>		30 14	Moon at perigee
	25 11	Juno in conjunction with Sun		30 16	Mercury 4° N. of Moon
	26 22	LAST QUARTER	Dec.	1 16	NEW MOON
	30 20	Jupiter 4° S. of Moon		2 03	Mercury $0^{\circ}.6$ S. of Neptune
	30 21	Venus 10° S. of Moon		5 08	Mars 4° N. of Moon
Oct.	2 20	Uranus 2° S. of Moon		8 18	FIRST QUARTER
	2 22	Saturn at opposition		10 10	Saturn $0^{\circ}.8$ S. of Moon Occ ⁿ .
	3 20	NEW MOON		10 10	Saturn stationary
	4 05	Venus 5° S. of <i>Regulus</i>		12 18	Moon at apogee
	4 14	Moon at perigee		16 23	FULL MOON
	5 14	Mercury 2° S. of Moon		22 11	Jupiter 3° S. of Moon
	6 02	Venus at greatest brilliancy		22 13	Solstice
	6 18	Neptune 4° N. of Moon		22 23	Jupiter stationary
	7 20	<i>Antares</i> 1° S. of Moon Occ ⁿ .		24 05	Uranus 2° S. of Moon
	8 13	Mars 3° N. of Moon		24 11	LAST QUARTER
	9 04	Mercury greatest elong. E. (25°)		28 05	Venus 5° N. of Moon
	10 12	FIRST QUARTER		28 07	Neptune 4° N. of Moon
	15 01	Jupiter $0^{\circ}.3$ N. of <i>Regulus</i>		28 19	Moon at perigee
	17 02	Saturn 1° S. of Moon Occ ⁿ .		28 23	Mercury in superior conjunction
	18 10	FULL MOON Eclipse		29 02	Venus $0^{\circ}.7$ N. of Neptune
	19 08	Moon at apogee		29 03	<i>Antares</i> 1° S. of Moon Occ ⁿ .
	21 10	Mercury stationary		31 04	NEW MOON

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date	Mercury		Venus		Date	Mercury		Venus	
	Elong.	Mag.	Elong.	Mag.		Elong.	Mag.	Elong.	Mag.
Jan. 0	W. 10°	-0.5	E. 13°	-3.4	July 4	E. 9°	+2.6	E. 45°	-4.1
5	8	0.6	14	3.4	9	E. 5	3.1	44	4.1
10	5	0.7	15	3.3	14	W. 9	2.6	43	4.1
15	W. 3	0.9	16	3.3	19	14	1.9	41	4.2
20	E. 2	1.0	17	3.3	24	18	1.2	39	4.2
25	E. 5	-1.0	E. 18	-3.3	29	W. 20	+0.5	E. 37	-4.2
30	8	1.0	20	3.3	Aug. 3	19	-0.1	34	4.1
Feb. 4	12	1.0	21	3.3	8	16	0.7	30	4.1
9	15	0.9	22	3.3	13	12	1.1	25	3.9
14	18	-0.5	23	3.3	18	7	1.4	19	3.7
19	E. 18	+0.1	E. 24	-3.3	23	W. 3	-1.5	E. 13	-3.4
24	14	1.0	25	3.4	28	E. 4	1.3	E. 9	3.2
Mar. 1	E. 7	2.2	27	3.4	Sept. 2	8	0.9	W. 10	3.3
6	W. 5	2.7	28	3.4	7	12	0.6	15	3.6
11	13	1.9	29	3.4	12	15	0.4	21	3.8
16	W. 20	+1.3	E. 30	-3.4	17	E. 18	-0.2	W. 26	-4.0
21	25	0.9	31	3.4	22	21	0.0	31	4.2
26	27	0.7	32	3.4	27	23	+0.1	35	4.2
31	28	0.5	33	3.4	Oct. 2	24	0.1	38	4.3
Apr. 5	27	0.4	34	3.5	7	25	0.2	41	4.3
10	W. 26	+0.3	E. 35	-3.5	12	E. 25	+0.3	W. 43	-4.3
15	24	+0.1	36	3.5	17	24	0.5	44	4.2
20	21	-0.1	37	3.5	22	20	0.8	45	4.2
25	17	0.4	38	3.5	27	12	1.6	46	4.2
30	13	0.8	39	3.6	Nov. 1	E. 2	3.0	46	4.1
May 5	W. 8	-1.3	E. 40	-3.6	6	W. 9	+1.7	W. 47	-4.1
10	W. 2	1.8	41	3.6	11	17	+0.5	47	4.0
15	E. 4	1.7	42	3.6	16	19	-0.2	47	4.0
20	10	1.3	43	3.7	21	19	0.5	46	3.9
25	15	0.8	43	3.7	26	17	0.5	46	3.9
30	E. 19	-0.3	E. 44	-3.7	Dec. 1	W. 15	-0.6	W. 45	-3.8
June 4	22	+0.1	45	3.8	6	13	0.6	45	3.8
9	24	0.5	45	3.8	11	10	0.6	44	3.8
14	24	0.8	45	3.9	16	7	0.6	43	3.7
19	23	1.2	45	3.9	21	5	0.7	43	3.7
24	E. 20	+1.5	E. 45	-4.0	26	W. 2	-0.8	W. 42	-3.7
29	15	2.0	45	4.0	31	E. 2	0.8	41	3.6
July 4	E. 9	+2.6	E. 45	-4.1	36	E. 5	-0.8	W. 40	-3.6

MINOR PLANETS

		Stationary	Opposition	Stationary	Conjunction
Ceres	...	—	—	Feb. 8	Aug. 23
Pallas	...	—	—	—	June 8
Juno	...	—	Jan. 27	Mar. 6	Sept. 25
Vesta	...	Apr. 4	May 15	July 1	—

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h U.T.

Date	Mars		Jupiter		Saturn		Uranus	Neptune	Pluto
	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Elong.	Elong.
Jan. 0	W. 85°	+1.1	W. 157°	-2.1	E. 75°	+1.4	W. 104°	W. 45°	W. 108°
10	91	1.0	168	2.2	66	1.4	115	55	118
20	97	0.8	W. 179	2.2	56	1.4	125	65	127
30	103	0.6	E. 169	2.2	47	1.3	135	75	137
Feb. 9	110	0.4	157	2.1	38	1.3	146	85	146
19	W. 118	+0.1	E. 146	-2.1	E. 29	+1.3	W. 156	W. 95	W. 155
Mar. 1	127	-0.1	135	2.0	20	1.2	167	105	W. 162
11	136	0.4	125	2.0	11	1.2	W. 177	115	E. 165
21	147	0.7	115	1.9	E. 3	1.2	E. 172	125	161
31	159	1.0	105	1.8	W. 7	1.1	162	135	154
Apr. 10	W. 172	-1.2	E. 96	-1.8	W. 15	+1.1	E. 152	W. 145	E. 146
20	E. 174	1.3	87	1.7	23	1.1	142	155	137
30	161	1.2	78	1.6	32	1.1	132	165	128
May 10	148	1.0	69	1.6	41	1.1	122	W. 175	119
20	137	0.8	61	1.5	49	1.1	112	E. 174	109
30	E. 127	-0.6	E. 53	-1.5	W. 58	+1.1	E. 102	E. 165	E. 100
June 9	119	0.4	45	1.4	67	1.0	93	155	90
19	111	-0.2	38	1.4	76	1.0	83	145	81
29	105	0.0	30	1.3	85	1.0	74	135	72
July 9	99	+0.1	23	1.3	94	1.0	65	126	63
19	E. 94	+0.3	E. 15	-1.3	W. 103	+0.9	E. 56	E. 116	E. 55
29	89	0.4	8	1.3	113	0.9	47	106	46
Aug. 8	85	0.5	E. 1	1.3	122	0.8	38	97	37
18	81	0.6	W. 7	1.3	132	0.7	29	87	29
28	78	0.7	14	1.3	142	0.7	20	78	21
Sept. 7	E. 74	+0.7	W. 22	-1.3	W. 153	+0.6	E. 11	E. 68	E. 16
17	71	0.8	29	1.3	163	0.6	E. 2	59	W. 15
27	68	0.9	37	1.4	W. 173	0.6	W. 8	49	19
Oct. 7	65	0.9	45	1.4	E. 175	0.6	17	40	26
17	63	1.0	53	1.4	165	0.6	26	30	35
27	E. 60	+1.0	W. 62	-1.5	E. 154	+0.7	W. 36	E. 20	W. 43
Nov. 6	58	1.0	70	1.5	144	0.8	45	11	52
16	55	1.1	79	1.6	133	0.8	55	E. 2	61
26	52	1.1	88	1.7	123	0.9	64	W. 9	71
Dec. 6	50	1.2	98	1.7	113	0.9	74	19	81
16	E. 48	+1.2	W. 108	-1.8	E. 102	+1.0	W. 84	W. 28	W. 91
26	45	1.2	118	1.9	92	1.0	94	38	100
36	E. 43	+1.3	W. 128	-1.9	E. 83	+1.1	W. 104	W. 48	W. 110

Magnitudes at opposition: Uranus 5.7 Neptune 7.7 Pluto 15

VISUAL MAGNITUDES OF MINOR PLANETS

	Jan. 10	Feb. 19	Mar. 31	May 10	June 19	July 29	Sept. 7	Oct. 17	Nov. 26	Dec. 36
Ceres	6.6	7.0	7.5	7.8	8.0	8.1	8.2	8.1	7.8	7.5
Pallas	8.6	8.8	8.9	8.8	8.7	8.6	8.4	8.2	7.8	7.4
Juno	7.9	8.2	8.9	9.6	10.2	10.6	10.8	10.9	10.9	10.7
Vesta	7.2	6.6	6.0	5.6	5.7	6.3	6.8	7.3	7.6	7.8

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
Jan.	2439				2446		
	0 490.5	^h ^m ^s 6 35 53.152	^s 53.827	−0.675	171.0	Jan. 0 17 21 15.794	15.122
	1 491.5	6 39 49.709	50.382	−.673	172.0	1 17 17 19.885	19.213
	2 492.5	6 43 46.263	46.937	−.675	173.0	2 17 13 23.978	23.303
	3 493.5	6 47 42.815	43.493	−.677	174.0	3 17 09 28.071	27.394
	4 494.5	6 51 39.368	40.048	−.680	175.0	4 17 05 32.164	31.484
	5 495.5	6 55 35.922	36.603	−0.681	176.0	5 17 01 36.253	35.575
	6 496.5	6 59 32.479	33.159	−.680	177.0	6 16 57 40.340	39.665
	7 497.5	7 03 29.040	29.714	−.675	178.0	7 16 53 44.423	43.756
	8 498.5	7 07 25.603	26.270	−.667	179.0	8 16 49 48.505	47.846
	9 499.5	7 11 22.167	22.825	−.658	180.0	9 16 45 52.586	51.937
	10 500.5	7 15 18.732	19.380	−0.648	181.0	10 16 41 56.668	56.028
	11 501.5	7 19 15.296	15.936	−.640	182.0	11 16 38 00.752	00.118
	12 502.5	7 23 11.857	12.491	−.634	183.0	12 16 34 04.838	04.209
	13 503.5	7 27 08.416	09.046	−.630	184.0	13 16 30 08.927	08.299
	14 504.5	7 31 04.972	05.602	−.630	185.0	14 16 26 13.018	12.390
	15 505.5	7 35 01.526	02.157	−0.631	186.0	15 16 22 17.112	16.480
	16 506.5	7 38 58.078	58.712	−.634	187.0	16 16 18 21.206	20.571
	17 507.5	7 42 54.630	55.268	−.638	188.0	17 16 14 25.300	24.661
	18 508.5	7 46 51.182	51.823	−.642	189.0	18 16 10 29.394	28.752
	19 509.5	7 50 47.734	48.379	−.644	190.0	19 16 06 33.485	32.842
	20 510.5	7 54 44.289	44.934	−0.645	191.0	20 16 02 37.575	36.933
	21 511.5	7 58 40.846	41.489	−.643	192.0	21 15 58 41.662	41.023
	22 512.5	8 02 37.406	38.045	−.639	193.0	22 15 54 45.746	45.114
	23 513.5	8 06 33.968	34.600	−.632	194.0	23 15 50 49.829	49.204
	24 514.5	8 10 30.532	31.155	−.623	195.0	24 15 46 53.910	53.295
	25 515.5	8 14 27.097	27.711	−0.614	196.0	25 15 42 57.993	57.386
	26 516.5	8 18 23.660	24.266	−.606	197.0	26 15 39 02.077	01.476
	27 517.5	8 22 20.220	20.821	−.601	198.0	27 15 35 06.165	05.567
	28 518.5	8 26 16.777	17.377	−.600	199.0	28 15 31 10.257	09.657
	29 519.5	8 30 13.330	13.932	−.603	200.0	29 15 27 14.352	13.748
Feb.	30 520.5	8 34 09.880	10.488	−0.607	201.0	30 15 23 18.447	17.838
	31 521.5	8 38 06.431	07.043	−.612	202.0	31 15 19 22.542	21.929
	1 522.5	8 42 02.982	03.598	−.616	203.0	1 15 15 26.634	26.019
	2 523.5	8 45 59.537	60.154	−.617	204.0	2 15 11 30.724	30.110
	3 524.5	8 49 56.094	56.709	−.615	205.0	3 15 07 34.811	34.200
	4 525.5	8 53 52.654	53.264	−0.610	206.0	4 15 03 38.895	38.291
	5 526.5	8 57 49.216	49.820	−.604	207.0	5 14 59 42.979	42.381
	6 527.5	9 01 45.778	46.375	−.597	208.0	6 14 55 47.063	46.472
	7 528.5	9 05 42.340	42.930	−.591	209.0	7 14 51 51.149	50.563
	8 529.5	9 09 38.899	39.486	−.586	210.0	8 14 47 55.236	54.653
	9 530.5	9 13 35.457	36.041	−0.585	211.0	9 14 43 59.327	58.744
	10 531.5	9 17 32.011	32.597	−.586	212.0	10 14 40 03.420	02.834
	11 532.5	9 21 28.563	29.152	−.589	213.0	11 14 36 07.515	06.925
	12 533.5	9 25 25.113	25.707	−.594	214.0	12 14 32 11.612	11.015
	13 534.5	9 29 21.662	22.263	−.601	215.0	13 14 28 15.709	15.106
	14 535.5	9 33 18.211	18.818	−0.607	216.0	14 14 24 19.805	19.196
	15 536.5	9 37 14.761	15.373	−0.613	217.0	15 14 20 23.900	23.287

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
Feb. 15	536.5	^h 9 ^m 37 ^s 14.761	^s 15.373	−0.613	217.0	^d 15 ^h 14 ^m 20 ^s 23.900	^s 23.287
16	537.5	9 41 11.312	11.929	.617	218.0	16 14 16 27.994	27.377
17	538.5	9 45 07.866	08.484	.618	219.0	17 14 12 32.084	31.468
18	539.5	9 49 04.422	05.039	.618	220.0	18 14 08 36.173	35.558
19	540.5	9 53 00.980	01.595	.614	221.0	19 14 04 40.259	39.649
20	541.5	9 56 57.541	58.150	−0.609	222.0	20 14 00 44.343	43.739
21	542.5	10 00 54.102	54.706	.603	223.0	21 13 56 48.428	47.830
22	543.5	10 04 50.664	51.261	.597	224.0	22 13 52 52.514	51.921
23	544.5	10 08 47.223	47.816	.594	225.0	23 13 48 56.602	56.011
24	545.5	10 12 43.778	44.372	.593	226.0	24 13 45 00.695	00.102
25	546.5	10 16 40.330	40.927	−0.597	227.0	25 13 41 04.791	04.192
26	547.5	10 20 36.879	37.482	.603	228.0	26 13 37 08.889	08.283
27	548.5	10 24 33.427	34.038	.611	229.0	27 13 33 12.986	12.373
28	549.5	10 28 29.976	30.593	.617	230.0	28 13 29 17.082	16.464
Mar. 1	550.5	10 32 26.527	27.149	.621	231.0	Mar. 1 13 25 21.175	20.554
2	551.5	10 36 23.081	23.704	−0.622	232.0	2 13 21 25.264	24.645
3	552.5	10 40 19.639	20.259	.620	233.0	3 13 17 29.352	28.735
4	553.5	10 44 16.199	16.815	.616	234.0	4 13 13 33.437	32.826
5	554.5	10 48 12.759	13.370	.611	235.0	5 13 09 37.523	36.916
6	555.5	10 52 09.319	09.925	.607	236.0	6 13 05 41.610	41.007
7	556.5	10 56 05.876	06.481	−0.604	237.0	7 13 01 45.700	45.097
8	557.5	11 00 02.432	03.036	.604	238.0	8 12 57 49.791	49.188
9	558.5	11 03 58.985	59.591	.606	239.0	9 12 53 53.886	53.279
10	559.5	11 07 55.535	56.147	.611	240.0	10 12 49 57.982	57.369
11	560.5	11 11 52.084	52.702	.618	241.0	11 12 46 02.080	01.460
12	561.5	11 15 48.631	49.258	−0.626	242.0	12 12 42 06.179	05.550
13	562.5	11 19 45.178	45.813	.635	243.0	13 12 38 10.278	09.641
14	563.5	11 23 41.726	42.368	.642	244.0	14 12 34 14.375	13.731
15	564.5	11 27 38.275	38.924	.648	245.0	15 12 30 18.471	17.822
16	565.5	11 31 34.827	35.479	.652	246.0	16 12 26 22.564	21.912
17	566.5	11 35 31.381	32.034	−0.654	247.0	17 12 22 26.655	26.003
18	567.5	11 39 27.937	28.590	.653	248.0	18 12 18 30.743	30.093
19	568.5	11 43 24.495	25.145	.650	249.0	19 12 14 34.830	34.184
20	569.5	11 47 21.055	21.700	.646	250.0	20 12 10 38.916	38.274
21	570.5	11 51 17.614	18.256	.642	251.0	21 12 06 43.003	42.365
22	571.5	11 55 14.173	14.811	−0.638	252.0	22 12 02 47.091	46.455
23	572.5	11 59 10.729	11.367	.638	253.0	23 11 58 51.183	50.546
24	573.5	12 03 07.281	07.922	.641	254.0	24 11 54 55.278	54.637
25	574.5	12 07 03.831	04.477	.647	255.0	25 11 50 59.376	58.727
26	575.5	12 11 00.378	01.033	.655	256.0	26 11 47 03.475	02.818
27	576.5	12 14 56.925	57.588	−0.663	257.0	27 11 43 07.573	06.908
28	577.5	12 18 53.475	54.143	.669	258.0	28 11 39 11.667	10.999
29	578.5	12 22 50.027	50.699	.671	259.0	29 11 35 15.758	15.089
30	579.5	12 26 46.584	47.254	.670	260.0	30 11 31 19.846	19.180
31	580.5	12 30 43.143	43.809	.666	261.0	31 11 27 23.932	23.270
Apr. 1	581.5	12 34 39.704	40.365	−0.661	262.0	Apr. 1 11 23 28.017	27.361
2	582.5	12 38 36.264	36.920	−0.656	263.0	2 11 19 32.104	31.451

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
Apr. 1	581.5	^h 12 ^m 34 ^s 39.704	^s 40.365	−0.661	262.0	Apr. 1 ^d 11 ^h 23 ^m 28.017	^s 27.361
2	582.5	12 38 36.264	36.920	.656	263.0	2 11 19 32.104	31.451
3	583.5	12 42 32.823	33.476	.653	264.0	3 11 15 36.192	35.542
4	584.5	12 46 29.379	30.031	.652	265.0	4 11 11 40.283	39.632
5	585.5	12 50 25.933	26.586	.654	266.0	5 11 07 44.376	43.723
6	586.5	12 54 22.484	23.142	−0.658	267.0	6 11 03 48.472	47.814
7	587.5	12 58 19.033	19.697	.664	268.0	7 10 59 52.570	51.904
8	588.5	13 02 15.581	16.252	.672	269.0	8 10 55 56.668	55.995
9	589.5	13 06 12.128	12.808	.679	270.0	9 10 52 00.766	00.085
10	590.5	13 10 08.676	09.363	.687	271.0	10 10 48 04.864	04.176
11	591.5	13 14 05.226	05.918	−0.693	272.0	11 10 44 08.959	08.266
12	592.5	13 18 01.777	02.474	.697	273.0	12 10 40 13.053	12.357
13	593.5	13 21 58.331	59.029	.698	274.0	13 10 36 17.144	16.447
14	594.5	13 25 54.887	55.585	.697	275.0	14 10 32 21.232	20.538
15	595.5	13 29 51.446	52.140	.694	276.0	15 10 28 25.319	24.628
16	596.5	13 33 48.006	48.695	−0.690	277.0	16 10 24 29.404	28.719
17	597.5	13 37 44.566	45.251	.685	278.0	17 10 20 33.490	32.809
18	598.5	13 41 41.126	41.806	.680	279.0	18 10 16 37.577	36.900
19	599.5	13 45 37.683	38.361	.678	280.0	19 10 12 41.667	40.990
20	600.5	13 49 34.238	34.917	.679	281.0	20 10 08 45.759	45.081
21	601.5	13 53 30.790	31.472	−0.682	282.0	21 10 04 49.855	49.172
22	602.5	13 57 27.339	28.027	.689	283.0	22 10 00 53.952	53.262
23	603.5	14 01 23.887	24.583	.696	284.0	23 09 56 58.049	57.353
24	604.5	14 05 20.437	21.138	.701	285.0	24 09 53 02.144	01.443
25	605.5	14 09 16.990	17.694	.704	286.0	25 09 49 06.235	05.534
26	606.5	14 13 13.547	14.249	−0.702	287.0	26 09 45 10.323	09.624
27	607.5	14 17 10.107	10.804	.697	288.0	27 09 41 14.407	13.715
28	608.5	14 21 06.670	07.360	.690	289.0	28 09 37 18.490	17.805
29	609.5	14 25 03.232	03.915	.683	290.0	29 09 33 22.574	21.896
30	610.5	14 28 59.794	60.470	.676	291.0	30 09 29 26.659	25.986
May 1	611.5	14 32 56.353	57.026	−0.672	292.0	May 1 09 25 30.747	30.077
2	612.5	14 36 52.910	53.581	.671	293.0	2 09 21 34.837	34.167
3	613.5	14 40 49.464	50.136	.673	294.0	3 09 17 38.930	38.258
4	614.5	14 44 46.015	46.692	.676	295.0	4 09 13 43.025	42.348
5	615.5	14 48 42.565	43.247	.682	296.0	5 09 09 47.121	46.439
6	616.5	14 52 39.115	39.803	−0.688	297.0	6 09 05 51.217	50.530
7	617.5	14 56 35.665	36.358	.693	298.0	7 09 01 55.313	54.620
8	618.5	15 00 32.216	32.913	.697	299.0	8 08 57 59.407	58.711
9	619.5	15 04 28.769	29.469	.700	300.0	9 08 54 03.499	02.801
10	620.5	15 08 25.324	26.024	.700	301.0	10 08 50 07.589	06.892
11	621.5	15 12 21.882	22.579	−0.697	302.0	11 08 46 11.676	10.982
12	622.5	15 16 18.442	19.135	.692	303.0	12 08 42 15.761	15.073
13	623.5	15 20 15.004	15.690	.686	304.0	13 08 38 19.845	19.163
14	624.5	15 24 11.567	12.245	.679	305.0	14 08 34 23.928	23.254
15	625.5	15 28 08.129	08.801	.672	306.0	15 08 30 28.013	27.344
16	626.5	15 32 04.689	05.356	−0.667	307.0	16 08 26 32.099	31.435
17	627.5	15 36 01.247	01.912	−0.665	308.0	17 08 22 36.189	35.525

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
May 17	627.5	^h 15 ^m 36 ^s 01.247	^s 01.912	−0.665	308.0	May ^d 17 ^h 08 ^m 22 ^s 36.189	^s 35.525
18	628.5	15 39 57.801	58.467	.666	309.0	18 08 18 40.281	39.616
19	629.5	15 43 54.353	55.022	.669	310.0	19 08 14 44.375	43.706
20	630.5	15 47 50.904	51.578	.674	311.0	20 08 10 48.471	47.797
21	631.5	15 51 47.455	48.133	.678	312.0	21 08 06 52.565	51.888
22	632.5	15 55 44.009	44.688	−0.680	313.0	22 08 02 56.656	55.978
23	633.5	15 59 40.566	41.244	.678	314.0	23 07 59 00.743	00.069
24	634.5	16 03 37.127	37.799	.672	315.0	24 07 55 04.826	04.159
25	635.5	16 07 33.691	34.354	.663	316.0	25 07 51 08.907	08.250
26	636.5	16 11 30.257	30.910	.653	317.0	26 07 47 12.988	12.340
27	637.5	16 15 26.822	27.465	−0.644	318.0	27 07 43 17.070	16.431
28	638.5	16 19 23.384	24.021	.636	319.0	28 07 39 21.154	20.521
29	639.5	16 23 19.944	20.576	.632	320.0	29 07 35 25.241	24.612
30	640.5	16 27 16.501	17.131	.630	321.0	30 07 31 29.331	28.702
31	641.5	16 31 13.056	13.687	.631	322.0	31 07 27 33.423	32.793
June 1	642.5	16 35 09.608	10.242	−0.634	323.0	June 1 07 23 37.517	36.883
2	643.5	16 39 06.160	06.797	.637	324.0	2 07 19 41.611	40.974
3	644.5	16 43 02.712	03.353	.641	325.0	3 07 15 45.705	45.065
4	645.5	16 46 59.264	59.908	.644	326.0	4 07 11 49.798	49.155
5	646.5	16 50 55.818	56.463	.645	327.0	5 07 07 53.889	53.246
6	647.5	16 54 52.375	53.019	−0.644	328.0	6 07 03 57.977	57.336
7	648.5	16 58 48.934	49.574	.640	329.0	7 07 00 02.063	01.427
8	649.5	17 02 45.496	46.130	.634	330.0	8 06 56 06.147	05.517
9	650.5	17 06 42.059	42.685	.626	331.0	9 06 52 10.229	09.608
10	651.5	17 10 38.623	39.240	.617	332.0	10 06 48 14.311	13.698
11	652.5	17 14 35.187	35.796	−0.608	333.0	11 06 44 18.393	17.789
12	653.5	17 18 31.750	32.351	.601	334.0	12 06 40 22.478	21.879
13	654.5	17 22 28.309	28.906	.597	335.0	13 06 36 26.565	25.970
14	655.5	17 26 24.866	25.462	.596	336.0	14 06 32 30.655	30.060
15	656.5	17 30 21.420	22.017	.597	337.0	15 06 28 34.747	34.151
16	657.5	17 34 17.972	18.572	−0.600	338.0	16 06 24 38.841	38.241
17	658.5	17 38 14.525	15.128	.603	339.0	17 06 20 42.934	42.332
18	659.5	17 42 11.078	11.683	.605	340.0	18 06 16 47.026	46.423
19	660.5	17 46 07.635	08.239	.603	341.0	19 06 12 51.114	50.513
20	661.5	17 50 04.196	04.794	.598	342.0	20 06 08 55.198	54.604
21	662.5	17 54 00.760	01.349	−0.589	343.0	21 06 04 59.279	58.694
22	663.5	17 57 57.326	57.905	.579	344.0	22 06 01 03.359	02.785
23	664.5	18 01 53.892	54.460	.568	345.0	23 05 57 07.439	06.875
24	665.5	18 05 50.457	51.015	.559	346.0	24 05 53 11.521	10.966
25	666.5	18 09 47.019	47.571	.552	347.0	25 05 49 15.606	15.056
26	667.5	18 13 43.577	44.126	−0.549	348.0	26 05 45 19.694	19.147
27	668.5	18 17 40.133	40.681	.548	349.0	27 05 41 23.784	23.237
28	669.5	18 21 36.687	37.237	.550	350.0	28 05 37 27.877	27.328
29	670.5	18 25 33.239	33.792	.553	351.0	29 05 33 31.970	31.418
30	671.5	18 29 29.791	30.348	.556	352.0	30 05 29 36.064	35.509
July 1	672.5	18 33 26.344	26.903	−0.559	353.0	July 1 05 25 40.157	39.599
2	673.5	18 37 22.898	23.458	−0.560	354.0	2 05 21 44.249	43.690

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
July	2439				2446		
	1 672.5	^h 18 ^m 33 ^s 26.344	^s 26.903	^s -0.559	353.0	July 1 ^d 05 ^h 25 ^m 40.157	^s 39.599
	2 673.5	18 37 22.898	23.458	.560	354.0	2 05 21 44.249	43.690
	3 674.5	18 41 19.454	20.014	.560	355.0	3 05 17 48.338	47.781
	4 675.5	18 45 16.013	16.569	.557	356.0	4 05 13 52.425	51.871
	5 676.5	18 49 12.573	13.124	.551	357.0	5 05 09 56.510	55.962
	6 677.5	18 53 09.137	09.680	-0.543	358.0	6 05 06 00.592	00.052
	7 678.5	18 57 05.701	06.235	.534	359.0	7 05 02 04.674	04.143
	8 679.5	19 01 02.265	02.790	.525	360.0	8 04 58 08.755	08.233
	9 680.5	19 04 58.828	59.346	.518	361.0	9 04 54 12.839	12.324
	10 681.5	19 08 55.388	55.901	.513	362.0	10 04 50 16.925	16.414
	11 682.5	19 12 51.945	52.457	-0.511	363.0	11 04 46 21.015	20.505
	12 683.5	19 16 48.500	49.012	.512	364.0	12 04 42 25.107	24.595
	13 684.5	19 20 45.052	45.567	.516	365.0	13 04 38 29.201	28.686
	14 685.5	19 24 41.603	42.123	.520	366.0	14 04 34 33.295	32.776
	15 686.5	19 28 38.156	38.678	.522	367.0	15 04 30 37.388	36.867
	16 687.5	19 32 34.711	35.233	-0.522	368.0	16 04 26 41.478	40.957
	17 688.5	19 36 31.270	31.789	.519	369.0	17 04 22 45.565	45.048
	18 689.5	19 40 27.831	28.344	.513	370.0	18 04 18 49.648	49.139
	19 690.5	19 44 24.396	24.899	.504	371.0	19 04 14 53.730	53.229
	20 691.5	19 48 20.961	21.455	.494	372.0	20 04 10 57.811	57.320
	21 692.5	19 52 17.525	18.010	-0.486	373.0	21 04 07 01.893	01.410
	22 693.5	19 56 14.086	14.566	.479	374.0	22 04 03 05.978	05.501
	23 694.5	20 00 10.645	11.121	.476	375.0	23 03 59 10.065	09.591
	24 695.5	20 04 07.201	07.676	.475	376.0	24 03 55 14.156	13.682
	25 696.5	20 08 03.754	04.232	.478	377.0	25 03 51 18.249	17.772
	26 697.5	20 12 00.305	00.787	-0.482	378.0	26 03 47 22.344	21.863
	27 698.5	20 15 56.856	57.342	.487	379.0	27 03 43 26.439	25.953
	28 699.5	20 19 53.407	53.898	.491	380.0	28 03 39 30.534	30.044
	29 700.5	20 23 49.959	50.453	.495	381.0	29 03 35 34.628	34.134
	30 701.5	20 27 46.512	47.008	.496	382.0	30 03 31 38.720	38.225
Aug.	31 702.5	20 31 43.068	43.564	-0.495	383.0	31 03 27 42.809	42.316
	1 703.5	20 35 39.627	40.119	.492	384.0	Aug. 1 03 23 46.896	46.406
	2 704.5	20 39 36.188	36.675	.487	385.0	2 03 19 50.981	50.497
	3 705.5	20 43 32.750	33.230	.480	386.0	3 03 15 55.065	54.587
	4 706.5	20 47 29.312	29.785	.473	387.0	4 03 11 59.148	58.678
	5 707.5	20 51 25.874	26.341	-0.466	388.0	5 03 08 03.232	02.768
	6 708.5	20 55 22.434	22.896	.462	389.0	6 03 04 07.319	06.859
	7 709.5	20 59 18.991	19.451	.461	390.0	7 03 00 11.409	10.949
	8 710.5	21 03 15.544	16.007	.463	391.0	8 02 56 15.502	15.040
	9 711.5	21 07 12.094	12.562	.468	392.0	9 02 52 19.598	19.130
	10 712.5	21 11 08.644	09.117	-0.474	393.0	10 02 48 23.694	23.221
	11 713.5	21 15 05.194	05.673	.479	394.0	11 02 44 27.790	27.311
	12 714.5	21 19 01.746	02.228	.482	395.0	12 02 40 31.883	31.402
	13 715.5	21 22 58.302	58.784	.481	396.0	13 02 36 35.972	35.492
	14 716.5	21 26 54.861	55.339	.478	397.0	14 02 32 40.059	39.583
	15 717.5	21 30 51.423	51.894	-0.472	398.0	15 02 28 44.143	43.674
	16 718.5	21 34 47.985	48.450	.465	399.0	16 02 24 48.227	47.764
	17 719.5	21 38 44.547	45.005	-0.458	400.0	17 02 20 52.311	51.855

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439	^h ^m ^s	^s	^s	2446	^d ^h ^m ^s	^s
Aug. 16	718.5	21 34 47.985	48.450	-0.465	400.0	Aug. 17 02 20 52.311	51.855
17	719.5	21 38 44.547	45.005	.458	401.0	18 02 16 56.397	55.945
18	720.5	21 42 41.107	41.560	.453	402.0	19 02 13 00.486	00.036
19	721.5	21 46 37.664	38.116	.451	403.0	20 02 09 04.577	04.126
20	722.5	21 50 34.219	34.671	.452	404.0	21 02 05 08.672	08.217
21	723.5	21 54 30.770	31.226	-0.456	405.0	22 02 01 12.768	12.307
22	724.5	21 58 27.320	27.782	.462	406.0	23 01 57 16.866	16.398
23	725.5	22 02 23.869	24.337	.469	407.0	24 01 53 20.963	20.488
24	726.5	22 06 20.417	20.893	.476	408.0	25 01 49 25.060	24.579
25	727.5	22 10 16.966	17.448	.482	409.0	26 01 45 29.155	28.669
26	728.5	22 14 13.517	14.003	-0.486	410.0	27 01 41 33.247	32.760
27	729.5	22 18 10.070	10.559	.489	411.0	28 01 37 37.338	36.850
28	730.5	22 22 06.626	07.114	.488	412.0	29 01 33 41.426	40.941
29	731.5	22 26 03.183	03.669	.486	413.0	30 01 29 45.512	45.032
30	732.5	22 29 59.743	60.225	.482	414.0	31 01 25 49.598	49.122
Sept. 31	733.5	22 33 56.303	56.780	-0.477	415.0	Sept. 1 01 21 53.684	53.213
1	734.5	22 37 52.863	53.335	.473	416.0	2 01 17 57.771	57.303
2	735.5	22 41 49.422	49.891	.469	417.0	3 01 14 01.861	01.394
3	736.5	22 45 45.977	46.446	.469	418.0	4 01 10 05.955	05.484
4	737.5	22 49 42.530	43.002	.472	419.0	5 01 06 10.052	09.575
5	738.5	22 53 39.079	39.557	-0.478	420.0	6 01 02 14.150	13.665
6	739.5	22 57 35.627	36.112	.485	421.0	7 00 58 18.248	17.756
7	740.5	23 01 32.175	32.668	.493	422.0	8 00 54 22.344	21.846
8	741.5	23 05 28.725	29.223	.498	423.0	9 00 50 26.436	25.937
9	742.5	23 09 25.278	25.778	.500	424.0	10 00 46 30.525	30.027
10	743.5	23 13 21.835	22.334	-0.499	425.0	11 00 42 34.611	34.118
11	744.5	23 17 18.394	18.889	.495	426.0	12 00 38 38.696	38.208
12	745.5	23 21 14.955	15.444	.489	427.0	13 00 34 42.782	42.299
13	746.5	23 25 11.515	12.000	.484	428.0	14 00 30 46.869	46.390
14	747.5	23 29 08.075	08.555	.481	429.0	15 00 26 50.959	50.480
15	748.5	23 33 04.631	05.111	-0.480	430.0	16 00 22 55.051	54.571
16	749.5	23 37 01.184	01.666	.482	431.0	17 00 18 59.146	58.661
17	750.5	23 40 57.735	58.221	.486	432.0	18 00 15 03.243	02.752
18	751.5	23 44 54.284	54.777	.493	433.0	19 00 11 07.342	06.842
19	752.5	23 48 50.831	51.332	.501	434.0	20 00 07 11.441	10.933
20	753.5	23 52 47.378	47.887	-0.509	435.0	21 00 03 15.539	15.023
21	754.5	23 56 43.926	44.443	.517	436.0	21 23 59 19.636	19.114
22	755.5	0 00 40.475	40.998	.523	437.0	22 23 55 23.730	23.204
23	756.5	0 04 37.026	37.553	.527	438.0	23 23 51 27.823	27.295
24	757.5	0 08 33.580	34.109	.529	439.0	24 23 47 31.913	31.385
25	758.5	0 12 30.136	30.664	-0.529	440.0	25 23 43 36.001	35.476
26	759.5	0 16 26.693	27.220	.526	441.0	26 23 39 40.088	39.567
27	760.5	0 20 23.252	23.775	.523	442.0	27 23 35 44.175	43.657
28	761.5	0 24 19.811	20.330	.519	443.0	28 23 31 48.262	47.748
29	762.5	0 28 16.370	16.886	.516	444.0	29 23 27 52.352	51.838
30	763.5	0 32 12.926	13.441	-0.515	445.0	30 23 23 56.444	55.929
Oct. 1	764.5	0 36 09.479	09.996	.517	446.0	Oct. 1 23 20 00.540	00.019
2	765.5	0 40 06.029	06.552	-0.522	447.0	2 23 16 04.638	04.110

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
Oct. 1	764.5	^h 0 ^m 36 ^s 09.479	^s 09.996	^s -0.517	446.0	Oct. 1 23 20 00.540	00.019
2	765.5	0 40 06.029	06.552	.522	447.0	2 23 16 04.638	04.110
3	766.5	0 44 02.577	03.107	.530	448.0	3 23 12 08.737	08.200
4	767.5	0 47 59.124	59.662	.538	449.0	4 23 08 12.834	12.291
5	768.5	0 51 55.673	56.218	.545	450.0	5 23 04 16.928	16.381
6	769.5	0 55 52.225	52.773	-0.548	451.0	6 23 00 21.018	20.472
7	770.5	0 59 48.781	49.329	.548	452.0	7 22 56 25.105	24.562
8	771.5	1 03 45.340	45.884	.544	453.0	8 22 52 29.189	28.653
9	772.5	1 07 41.902	42.439	.538	454.0	9 22 48 33.274	32.743
10	773.5	1 11 38.463	38.995	.532	455.0	10 22 44 37.360	36.834
11	774.5	1 15 35.023	35.550	-0.527	456.0	11 22 40 41.448	40.925
12	775.5	1 19 31.581	32.105	.525	457.0	12 22 36 45.539	45.015
13	776.5	1 23 28.135	28.661	.525	458.0	13 22 32 49.633	49.106
14	777.5	1 27 24.687	25.216	.529	459.0	14 22 28 53.729	53.196
15	778.5	1 31 21.237	21.771	.535	460.0	15 22 24 57.826	57.287
16	779.5	1 35 17.785	18.327	-0.542	461.0	16 22 21 01.925	01.377
17	780.5	1 39 14.333	14.882	.549	462.0	17 22 17 06.022	05.468
18	781.5	1 43 10.881	11.438	.556	463.0	18 22 13 10.119	09.558
19	782.5	1 47 07.431	07.993	.562	464.0	19 22 09 14.213	13.649
20	783.5	1 51 03.982	04.548	.566	465.0	20 22 05 18.305	17.739
21	784.5	1 55 00.536	01.104	-0.567	466.0	21 22 01 22.395	21.830
22	785.5	1 58 57.093	57.659	.566	467.0	22 21 57 26.483	25.920
23	786.5	2 02 53.651	54.214	.563	468.0	23 21 53 30.569	30.011
24	787.5	2 06 50.211	50.770	.559	469.0	24 21 49 34.654	34.101
25	788.5	2 10 46.771	47.325	.554	470.0	25 21 45 38.740	38.192
26	789.5	2 14 43.331	43.880	-0.550	471.0	26 21 41 42.828	42.283
27	790.5	2 18 39.889	40.436	.547	472.0	27 21 37 46.918	46.373
28	791.5	2 22 36.445	36.991	.546	473.0	28 21 33 51.011	50.464
29	792.5	2 26 32.998	33.547	.549	474.0	29 21 29 55.106	54.554
30	793.5	2 30 29.548	30.102	.554	475.0	30 21 25 59.203	58.645
31	794.5	2 34 26.097	26.657	-0.560	476.0	31 21 22 03.299	02.735
Nov. 1	795.5	2 38 22.646	23.213	.566	477.0	Nov. 1 21 18 07.393	06.826
2	796.5	2 42 19.199	19.768	.569	478.0	2 21 14 11.483	10.916
3	797.5	2 46 15.755	16.323	.568	479.0	3 21 10 15.569	15.007
4	798.5	2 50 12.315	12.879	.563	480.0	4 21 06 19.652	19.097
5	799.5	2 54 08.879	09.434	-0.555	481.0	5 21 02 23.734	23.188
6	800.5	2 58 05.443	05.990	.546	482.0	6 20 58 27.816	27.278
7	801.5	3 02 02.007	02.545	.538	483.0	7 20 54 31.900	31.369
8	802.5	3 05 58.568	59.100	.532	484.0	8 20 50 35.988	35.459
9	803.5	3 09 55.126	55.656	.530	485.0	9 20 46 40.079	39.550
10	804.5	3 13 51.681	52.211	-0.530	486.0	10 20 42 44.172	43.641
11	805.5	3 17 48.233	48.766	.533	487.0	11 20 38 48.266	47.731
12	806.5	3 21 44.784	45.322	.538	488.0	12 20 34 52.362	51.822
13	807.5	3 25 41.334	41.877	.543	489.0	13 20 30 56.458	55.912
14	808.5	3 29 37.885	38.432	.548	490.0	14 20 27 00.552	00.003
15	809.5	3 33 34.436	34.988	-0.551	491.0	15 20 23 04.645	04.093
16	810.5	3 37 30.990	31.543	-0.553	492.0	16 20 19 08.735	08.184

Date 0 ^h U.T.	Julian Date	Sidereal Time H.A. of First Point of Aries		Equation of Equi- noxes	G.S.D. 0 ^h S.T.	Universal Time Transit of First Point of Aries	
		Apparent	Mean			Apparent	Mean
	2439				2446		
Nov. 16	810.5	^h 3 ^m 37 ^s 30.990	^s 31.543	−0.553	492.0	Nov. 16 ^d 20 ^h 19 ^m 08.735	^s 08.184
17	811.5	3 41 27.546	28.099	.552	493.0	17 20 15 12.823	12.274
18	812.5	3 45 24.104	24.654	.549	494.0	18 20 11 16.908	16.365
19	813.5	3 49 20.665	21.209	.544	495.0	19 20 07 20.993	20.455
20	814.5	3 53 17.227	17.765	.538	496.0	20 20 03 25.076	24.546
21	815.5	3 57 13.790	14.320	−0.530	497.0	21 19 59 29.159	28.636
22	816.5	4 01 10.352	10.875	.523	498.0	22 19 55 33.244	32.727
23	817.5	4 05 06.913	07.431	.518	499.0	23 19 51 37.331	36.818
24	818.5	4 09 03.472	03.986	.514	500.0	24 19 47 41.420	40.908
25	819.5	4 13 00.028	00.541	.514	501.0	25 19 43 45.512	44.999
26	820.5	4 16 56.581	57.097	−0.516	502.0	26 19 39 49.606	49.089
27	821.5	4 20 53.133	53.652	.519	503.0	27 19 35 53.701	53.180
28	822.5	4 24 49.685	50.208	.523	504.0	28 19 31 57.794	57.270
29	823.5	4 28 46.238	46.763	.525	505.0	29 19 28 01.883	01.361
30	824.5	4 32 42.795	43.318	.524	506.0	30 19 24 05.969	05.451
Dec. 1	825.5	4 36 39.356	39.874	−0.518	507.0	Dec. 1 19 20 10.051	09.542
2	826.5	4 40 35.921	36.429	.508	508.0	2 19 16 14.130	13.632
3	827.5	4 44 32.488	32.984	.497	509.0	3 19 12 18.209	17.723
4	828.5	4 48 29.054	29.540	.485	510.0	4 19 08 22.289	21.813
5	829.5	4 52 25.619	26.095	.476	511.0	5 19 04 26.373	25.904
6	830.5	4 56 22.181	22.650	−0.469	512.0	6 19 00 30.460	29.994
7	831.5	5 00 18.740	19.206	.466	513.0	7 18 56 34.549	34.085
8	832.5	5 04 15.296	15.761	.466	514.0	8 18 52 38.641	38.176
9	833.5	5 08 11.849	12.317	.468	515.0	9 18 48 42.735	42.266
10	834.5	5 12 08.401	08.872	.470	516.0	10 18 44 46.828	46.357
11	835.5	5 16 04.954	05.427	−0.473	517.0	11 18 40 50.921	50.447
12	836.5	5 20 01.507	01.983	.475	518.0	12 18 36 55.012	54.538
13	837.5	5 23 58.062	58.538	.476	519.0	13 18 32 59.101	58.628
14	838.5	5 27 54.619	55.093	.474	520.0	14 18 29 03.188	02.719
15	839.5	5 31 51.179	51.649	.470	521.0	15 18 25 07.273	06.809
16	840.5	5 35 47.741	48.204	−0.463	522.0	16 18 21 11.356	10.900
17	841.5	5 39 44.304	44.759	.455	523.0	17 18 17 15.437	14.990
18	842.5	5 43 40.869	41.315	.446	524.0	18 18 13 19.519	19.081
19	843.5	5 47 37.433	37.870	.437	525.0	19 18 09 23.602	23.171
20	844.5	5 51 33.996	34.426	.430	526.0	20 18 05 27.686	27.262
21	845.5	5 55 30.556	30.981	−0.424	527.0	21 18 01 31.774	31.352
22	846.5	5 59 27.114	27.536	.422	528.0	22 17 57 35.864	35.443
23	847.5	6 03 23.670	24.092	.422	529.0	23 17 53 39.956	39.534
24	848.5	6 07 20.223	20.647	.424	530.0	24 17 49 44.049	43.624
25	849.5	6 11 16.775	17.202	.427	531.0	25 17 45 48.142	47.715
26	850.5	6 15 13.329	13.758	−0.429	532.0	26 17 41 52.232	51.805
27	851.5	6 19 09.885	10.313	.428	533.0	27 17 37 56.319	55.896
28	852.5	6 23 06.445	06.868	.423	534.0	28 17 33 60.403	59.986
29	853.5	6 27 03.009	03.424	.415	535.0	29 17 30 04.482	04.077
30	854.5	6 30 59.575	59.979	.404	536.0	30 17 26 08.561	08.167
31	855.5	6 34 56.143	56.535	−0.392	537.0	31 17 22 12.640	12.258
32	856.5	6 38 52.710	53.090	−0.380	538.0	32 17 18 16.721	16.348

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967.0	1950.0	Date				
									23° 26'
Jan. 0	278° 51' 31".7 3668.2	-32.0	+0.33	+8.09	+0.34	8.95	- 0.143	-11.033	43.040
1	279 52 39.9 3668.5	31.8	.31	8.03	.31	8.95	- 0.006	11.006	43.102
2	280 53 48.4 3668.9	31.7	.25	7.93	.25	8.95	+ 0.132	11.028	43.149
3	281 54 57.3 3669.2	31.6	.16	7.80	.16	8.95	0.270	11.075	43.173
4	282 56 06.5 3669.5	31.5	+ .05	7.64	+ .04	8.95	0.407	11.121	43.174
5	283 57 16.0 3669.8	-31.4	-0.08	+7.47	-0.09	8.95	+ 0.545	-11.138	43.152
6	284 58 25.8 3670.0	31.2	.22	7.28	.22	8.95	0.683	11.110	43.118
7	285 59 35.8 3670.0	31.0	.35	7.10	.36	8.95	0.820	11.029	43.084
8	287 00 45.8 3670.0	30.8	.47	6.93	.48	8.95	0.958	10.904	43.060
9	288 01 55.8 3670.0	30.5	.58	6.76	.59	8.95	1.096	10.753	43.054
10	289 03 05.8 3669.7	-30.2	-0.67	+6.62	-0.68	8.95	+ 1.233	-10.598	43.071
11	290 04 15.5 3669.4	29.9	.73	6.50	.74	8.95	1.371	10.462	43.108
12	291 05 24.9 3669.0	29.7	.76	6.40	.77	8.95	1.508	10.361	43.160
13	292 06 33.9 3668.6	29.5	.76	6.33	.78	8.95	1.646	10.304	43.219
14	293 07 42.5 3668.0	29.3	.74	6.29	.75	8.95	1.784	10.293	43.279
15	294 08 50.5 3667.3	-29.2	-0.69	+6.27	-0.70	8.95	+ 1.921	-10.318	43.330
16	295 09 57.8 3666.6	29.1	.61	6.28	.63	8.95	2.059	10.369	43.369
17	296 11 04.4 3665.9	29.0	.52	6.30	.54	8.95	2.197	10.432	43.392
18	297 12 10.3 3665.1	29.0	.41	6.33	.43	8.94	2.334	10.492	43.399
19	298 13 15.4 3664.2	28.9	.29	6.37	.31	8.94	2.472	10.533	43.390
20	299 14 19.6 3663.4	-28.7	-0.16	+6.42	-0.18	8.94	+ 2.610	-10.543	43.374
21	300 15 23.0 3662.4	28.6	- .04	6.47	- .06	8.94	2.747	10.514	43.351
22	301 16 25.4 3661.5	28.4	+ .09	6.50	+ .06	8.94	2.885	10.440	43.333
23	302 17 26.9 3660.6	28.1	.19	6.52	.17	8.94	3.022	10.326	43.326
24	303 18 27.5 3659.7	27.8	.29	6.53	.26	8.94	3.160	10.185	43.337
25	304 19 27.2 3658.7	-27.5	+0.35	+6.51	+0.33	8.94	+ 3.298	-10.038	43.373
26	305 20 25.9 3657.9	27.3	.39	6.45	.37	8.94	3.435	9.913	43.431
27	306 21 23.8 3657.2	27.1	.40	6.37	.37	8.94	3.573	9.834	43.506
28	307 22 21.0 3656.3	26.9	.38	6.25	.35	8.94	3.711	9.814	43.584
29	308 23 17.3 3655.6	26.8	.32	6.10	.29	8.93	3.848	9.853	43.652
30	309 24 12.9 3654.9	-26.7	+0.24	+5.92	+0.21	8.93	+ 3.986	- 9.928	43.695
Feb. 1	310 25 07.8 3654.2	26.7	.13	5.71	+ .11	8.93	4.124	10.011	43.712
2	311 26 02.0 3653.4	26.6	+ .01	5.49	- .02	8.93	4.261	10.070	43.705
3	312 26 55.4 3652.7	26.5	- .12	5.25	.15	8.93	4.399	10.086	43.683
4	313 27 48.1 3651.9	26.3	.25	5.02	.27	8.93	4.537	10.053	43.656
5	314 28 40.0 3651.1	-26.1	-0.37	+4.79	-0.40	8.93	+ 4.674	- 9.976	43.637
6	315 29 31.1 3650.1	25.8	.47	4.57	.50	8.93	4.812	9.870	43.635
7	316 30 21.2 3649.1	25.6	.56	4.38	.59	8.92	4.949	9.757	43.653
8	317 31 10.3 3648.0	25.3	.62	4.20	.65	8.92	5.087	9.656	43.691
9	318 31 58.3 3646.9	25.1	.65	4.06	.68	8.92	5.225	9.588	43.746
10	319 32 45.2 3645.6	-24.9	-0.66	+3.94	-0.69	8.92	+ 5.362	- 9.558	43.810
11	320 33 30.8 3644.2	24.8	.64	3.84	.66	8.92	5.500	9.575	43.874
12	321 34 15.0 3642.8	24.7	.59	3.77	.62	8.92	5.638	9.633	43.933
13	322 34 57.8 3641.3	24.7	.51	3.73	.54	8.91	5.775	9.719	43.980
14	323 35 39.1 3639.8	24.6	.42	3.70	.45	8.91	5.913	9.824	44.010
15	324 36 18.9 3638.1	-24.6	-0.31	+3.69	-0.34	8.91	+ 6.051	- 9.927	44.024
16	325 36 57.0	-24.6	-0.19	+3.68	-0.22	8.91	+ 6.188	-10.018	44.024

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] [″]		['] [″]	^h ^m ^s
Jan. 0	18 38 31.68 ^s	-23 08 58.9 ^s	0.983 3024	16 17.50	12 02 52.95 ^s
1	18 42 56.92 ^s	23 04 40.9 ^s + 258.0	.983 2920 - 104	16 17.51	12 03 21.52 ^s + 28.57
2	18 47 21.89 ^s	22 59 55.3 ^s 285.6	.983 2877 - 43	16 17.52	12 03 49.79 ^s 28.27
3	18 51 46.55 ^s	22 54 42.1 ^s 313.2	.983 2890 + 13	16 17.52	12 04 17.75 ^s 27.96
4	18 56 10.89 ^s	22 49 01.6 ^s 340.5	.983 2958 68	16 17.51	12 04 45.37 ^s 27.62
		367.8	117		27.24
5	19 00 34.87 ^s	-22 42 53.8 ^s	0.983 3075	16 17.50	12 05 12.61 ^s
6	19 04 58.46 ^s	22 36 18.9 ^s + 394.9	.983 3237 + 162	16 17.48	12 05 39.44 ^s + 26.83
7	19 09 21.63 ^s	22 29 17.1 ^s 421.8	.983 3443 206	16 17.46	12 06 05.83 ^s 26.39
8	19 13 44.35 ^s	22 21 48.7 ^s 448.4	.983 3692 249	16 17.44	12 06 31.76 ^s 25.93
9	19 18 06.59 ^s	22 13 53.8 ^s 474.9	.983 3979 287	16 17.41	12 06 57.19 ^s 25.43
		501.1	324		24.90
10	19 22 28.32 ^s	-22 05 32.7 ^s	0.983 4303	16 17.37	12 07 22.09 ^s
11	19 26 49.50 ^s	21 56 45.7 ^s + 527.0	.983 4666 + 363	16 17.34	12 07 46.43 ^s + 24.34
12	19 31 10.11 ^s	21 47 33.0 ^s 552.7	.983 5066 400	16 17.30	12 08 10.18 ^s 23.75
13	19 35 30.12 ^s	21 37 54.8 ^s 578.2	.983 5503 437	16 17.26	12 08 33.33 ^s 23.15
14	19 39 49.49 ^s	21 27 51.4 ^s 603.4	.983 5980 477	16 17.21	12 08 55.83 ^s 22.50
		628.2	517		21.84
15	19 44 08.22 ^s	-21 17 23.2 ^s	0.983 6497	16 17.16	12 09 17.67 ^s
16	19 48 26.27 ^s	21 06 30.5 ^s + 652.7	.983 7056 + 559	16 17.10	12 09 38.83 ^s + 21.16
17	19 52 43.64 ^s	20 55 13.5 ^s 677.0	.983 7658 602	16 17.04	12 09 59.29 ^s 20.46
18	19 57 00.29 ^s	20 43 32.6 ^s 700.9	.983 8307 649	16 16.98	12 10 19.03 ^s 19.74
19	20 01 16.22 ^s	20 31 28.1 ^s 724.5	.983 9002 695	16 16.91	12 10 38.03 ^s 19.00
		747.8	745		18.26
20	20 05 31.41 ^s	-20 19 00.3 ^s	0.983 9747	16 16.83	12 10 56.29 ^s
21	20 09 45.85 ^s	20 06 09.7 ^s + 770.6	.984 0544 + 797	16 16.75	12 11 13.78 ^s + 17.49
22	20 13 59.51 ^s	19 52 56.6 ^s 793.1	.984 1395 851	16 16.67	12 11 30.50 ^s 16.72
23	20 18 12.41 ^s	19 39 21.2 ^s 815.4	.984 2302 907	16 16.58	12 11 46.44 ^s 15.94
24	20 22 24.52 ^s	19 25 24.1 ^s 837.1	.984 3267 965	16 16.48	12 12 01.58 ^s 15.14
		858.5	1025		14.36
25	20 26 35.84 ^s	-19 11 05.6 ^s	0.984 4292	16 16.38	12 12 15.94 ^s
26	20 30 46.36 ^s	18 56 25.9 ^s + 879.7	.984 5379 + 1087	16 16.28	12 12 29.49 ^s + 13.55
27	20 34 56.08 ^s	18 41 25.7 ^s 900.2	.984 6529 1150	16 16.16	12 12 42.25 ^s 12.76
28	20 39 04.99 ^s	18 26 05.0 ^s 920.7	.984 7740 1211	16 16.04	12 12 54.20 ^s 11.95
29	20 43 13.11 ^s	18 10 24.4 ^s 940.6	.984 9011 1271	16 15.92	12 13 05.36 ^s 11.16
		960.2	1330		10.35
30	20 47 20.42 ^s	-17 54 24.2 ^s	0.985 0341	16 15.78	12 13 15.71 ^s
31	20 51 26.93 ^s	17 38 04.7 ^s + 979.5	.985 1726 + 1385	16 15.65	12 13 25.27 ^s + 9.56
Feb. 1	20 55 32.65 ^s	17 21 26.3 ^s 998.4	.985 3162 1436	16 15.50	12 13 34.03 ^s 8.76
2	20 59 37.57 ^s	17 04 29.4 ^s 1016.9	.985 4646 1484	16 15.36	12 13 41.99 ^s 7.96
3	21 03 41.70 ^s	16 47 14.4 ^s 1035.0	.985 6174 1528	16 15.21	12 13 49.16 ^s 7.17
		1052.7	1569		6.36
4	21 07 45.03 ^s	-16 29 41.7 ^s	0.985 7743	16 15.05	12 13 55.52 ^s
5	21 11 47.57 ^s	16 11 51.7 ^s + 1070.0	.985 9348 + 1605	16 14.89	12 14 01.09 ^s + 5.57
6	21 15 49.31 ^s	15 53 44.8 ^s 1086.9	.986 0988 1640	16 14.73	12 14 05.86 ^s 4.77
7	21 19 50.25 ^s	15 35 21.5 ^s 1103.3	.986 2659 1671	16 14.56	12 14 09.84 ^s 3.98
8	21 23 50.40 ^s	15 16 42.2 ^s 1119.3	.986 4361 1702	16 14.40	12 14 13.02 ^s 3.18
		1134.9	1730		2.39
9	21 27 49.75 ^s	-14 57 47.3 ^s	0.986 6091	16 14.23	12 14 15.41 ^s
10	21 31 48.30 ^s	14 38 37.2 ^s + 1150.1	.986 7848 + 1757	16 14.05	12 14 17.01 ^s + 1.60
11	21 35 46.07 ^s	14 19 12.5 ^s 1164.7	.986 9634 1786	16 13.88	12 14 17.82 ^s 0.81
12	21 39 43.05 ^s	13 59 33.4 ^s 1179.1	.987 1446 1812	16 13.70	12 14 17.86 ^s + 0.04
13	21 43 39.26 ^s	13 39 40.4 ^s 1193.0	.987 3287 1841	16 13.52	12 14 17.12 ^s - 0.74
		1206.4	1870		1.50
14	21 47 34.69 ^s	-13 19 34.0 ^s	0.987 5157	16 13.33	12 14 15.62 ^s
15	21 51 29.37 ^s	-12 59 14.7 ^s + 1219.3	0.987 7056 + 1899	16 13.14	12 14 13.37 ^s - 2.25

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic 23° 26'
			1967.0	1950.0	Date				
Feb. 15	325° 36' 57.0 3636.5	-24.6	-0.19	+3.68	-0.22	8.91	+ 6.188	-10.018	44.024
16	326 37 33.5 3634.7	24.5	- .07	3.69	- .09	8.91	6.326	10.082	44.011
17	327 38 08.2 3632.9	24.4	+ .06	3.69	+ .03	8.91	6.463	10.110	43.990
18	328 38 41.1 3631.2	24.2	.18	3.68	.16	8.90	6.601	10.098	43.970
19	329 39 12.3 3629.3	24.0	.29	3.67	.26	8.90	6.739	10.046	43.958
20	330 39 41.6 3627.4	-23.8	+0.38	+3.63	+0.36	8.90	+ 6.876	- 9.961	43.959
21	331 40 09.0 3625.7	23.5	.45	3.57	.43	8.90	7.014	9.860	43.983
22	332 40 34.7 3623.8	23.3	.50	3.49	.47	8.90	7.152	9.766	44.030
23	333 40 58.5 3622.0	23.1	.51	3.37	.49	8.89	7.289	9.706	44.097
24	334 41 20.5 3620.3	23.0	.49	3.21	.47	8.89	7.427	9.700	44.171
25	335 41 40.8 3618.7	-22.9	+0.44	+3.03	+0.42	8.89	+ 7.565	- 9.756	44.242
26	336 41 59.5 3617.1	22.8	.36	2.82	.34	8.89	7.702	9.860	44.292
27	337 42 16.6 3615.5	22.8	.25	2.58	.23	8.89	7.840	9.985	44.313
28	338 42 32.1 3614.0	22.8	+ .13	2.33	+ .11	8.88	7.977	10.094	44.306
Mar. 1	339 42 46.1 3612.5	22.7	.00	2.06	- .02	8.88	8.115	10.161	44.277
2	340 42 58.6 3611.0	-22.6	-0.14	+1.79	-0.15	8.88	+ 8.253	-10.176	44.241
3	341 43 09.6 3609.5	22.4	.26	1.53	.28	8.88	8.390	10.140	44.209
4	342 43 19.1 3608.0	22.2	.38	1.27	.39	8.88	8.528	10.070	44.194
5	343 43 27.1 3606.5	22.0	.47	1.04	.48	8.87	8.666	9.990	44.198
6	344 43 33.6 3604.8	21.7	.54	0.84	.55	8.87	8.803	9.921	44.223
7	345 43 38.4 3603.2	-21.6	-0.58	+0.66	-0.59	8.87	+ 8.941	- 9.879	44.263
8	346 43 41.6 3601.4	21.4	.59	0.51	.60	8.87	9.079	9.875	44.314
9	347 43 43.0 3599.6	21.3	.57	0.39	.58	8.86	9.216	9.914	44.369
10	348 43 42.6 3597.8	21.3	.52	0.30	.53	8.86	9.354	9.995	44.418
11	349 43 40.4 3595.9	21.2	.45	0.23	.46	8.86	9.491	10.107	44.456
12	350 43 36.3 3593.9	-21.2	-0.36	+0.18	-0.36	8.86	+ 9.629	-10.239	44.479
13	351 43 30.2 3591.9	21.2	.25	0.15	.26	8.85	9.767	10.374	44.485
14	352 43 22.1 3589.8	21.2	- .13	0.13	.13	8.85	9.904	10.498	44.473
15	353 43 11.9 3587.6	21.1	.00	0.12	- .01	8.85	10.042	10.597	44.449
16	354 42 59.5 3585.5	21.1	+ .13	0.11	+ .13	8.85	10.180	10.664	44.416
17	355 42 45.0 3583.2	-20.9	+0.25	+0.09	+0.25	8.84	+10.317	-10.689	44.380
18	356 42 28.2 3581.0	20.8	.36	0.07	.37	8.84	10.455	10.676	44.351
19	357 42 09.2 3578.7	20.6	.46	+0.03	.47	8.84	10.593	10.629	44.333
20	358 41 47.9 3576.4	20.4	.54	-0.03	.54	8.84	10.730	10.560	44.333
21	359 41 24.3 3574.1	20.2	.59	0.12	.59	8.83	10.868	10.489	44.353
22	0 40 58.4 3571.8	-20.0	+0.60	-0.25	+0.61	8.83	+11.006	-10.437	44.395
23	1 40 30.2 3569.6	19.8	.59	0.40	.60	8.83	11.143	10.427	44.452
24	2 39 59.8 3567.3	19.7	.54	0.58	.55	8.83	11.281	10.474	44.508
25	3 39 27.1 3565.3	19.7	.46	0.80	.48	8.83	11.418	10.573	44.553
26	4 38 52.4 3563.1	19.7	.36	1.04	.37	8.82	11.556	10.706	44.571
27	5 38 15.5 3561.3	-19.7	+0.23	-1.30	+0.25	8.82	+11.694	-10.838	44.558
28	6 37 36.8 3559.3	19.6	+ .09	1.57	+ .12	8.82	11.831	10.935	44.518
29	7 36 56.1 3557.5	19.5	- .04	1.85	- .02	8.81	11.969	10.974	44.463
30	8 36 13.6 3555.7	19.3	.18	2.11	.15	8.81	12.107	10.954	44.409
31	9 35 29.3 3554.0	19.1	.30	2.37	.27	8.81	12.244	10.889	44.367
Apr. 1	10 34 43.3 3552.2	-18.9	-0.40	-2.60	-0.37	8.81	+12.382	-10.805	44.349
2	11 33 55.5	-18.7	-0.48	-2.81	-0.45	8.80	+12.520	-10.725	44.352

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s ^s	[°] ['] ["] ["]		['] ["] ["]	^h ^m ^s ^s
Feb. 15	21 51 29.37 ^s 233.93	-12 59 14.7 ["] +1232.0	0.987 7056 +1930	16 13.14	12 14 13.37 ^s - 3.01
16	21 55 23.30 ^s 233.19	12 38 42.7 ["] 1244.0	.987 8986 1962	16 12.95	12 14 10.36 ^s 3.73
17	21 59 16.49 ^s 232.47	12 17 58.7 ["] 1255.8	.988 0948 1997	16 12.76	12 14 06.63 ^s 4.46
18	22 03 08.96 ^s 231.75	11 57 02.9 ["] 1267.1	.988 2945 2031	16 12.56	12 14 02.17 ^s 5.16
19	22 07 00.71 ^s 231.05	11 35 55.8 ["] 1277.9	.988 4976 2069	16 12.36	12 13 57.01 ^s 5.87
20	22 10 51.76 ^s 230.36	-11 14 37.9 ["] +1288.3	0.988 7045 +2110	16 12.16	12 13 51.14 ^s - 6.54
21	22 14 42.12 ^s 229.70	10 53 09.6 ["] 1298.4	.988 9155 2153	16 11.95	12 13 44.60 ^s - 7.20
22	22 18 31.82 ^s 229.04	10 31 31.2 ["] 1307.9	.989 1308 2196	16 11.74	12 13 37.40 ^s 7.84
23	22 22 20.86 ^s 228.40	10 09 43.3 ["] 1317.2	.989 3504 2243	16 11.53	12 13 29.56 ^s 8.47
24	22 26 09.26 ^s 227.79	9 47 46.1 ["] 1326.0	.989 5747 2288	16 11.31	12 13 21.09 ^s 9.06
25	22 29 57.05 ^s 227.19	-9 25 40.1 ["] +1334.5	0.989 8035 +2335	16 11.08	12 13 12.03 ^s - 9.65
26	22 33 44.24 ^s 226.62	9 03 25.6 ["] 1342.6	.990 0370 2379	16 10.85	12 13 02.38 ^s - 10.21
27	22 37 30.86 ^s 226.08	8 41 03.0 ["] 1350.4	.990 2749 2422	16 10.62	12 12 52.17 ^s - 10.74
28	22 41 16.94 ^s 225.55	8 18 32.6 ["] 1357.7	.990 5171 2460	16 10.38	12 12 41.43 ^s - 11.26
Mar. 1	22 45 02.49 ^s 225.04	7 55 54.9 ["] 1364.8	.990 7631 2495	16 10.14	12 12 30.17 ^s - 11.76
2	22 48 47.53 ^s 224.57	-7 33 10.1 ["] +1371.5	0.991 0126 +2526	16 09.90	12 12 18.41 ^s - 12.23
3	22 52 32.10 ^s 224.09	7 10 18.6 ["] 1377.7	.991 2652 2552	16 09.65	12 12 06.18 ^s - 12.70
4	22 56 16.19 ^s 223.64	6 47 20.9 ["] 1383.5	.991 5204 2577	16 09.40	12 11 53.48 ^s - 13.14
5	22 59 59.83 ^s 223.21	6 24 17.4 ["] 1389.0	.991 7781 2595	16 09.15	12 11 40.34 ^s - 13.56
6	23 03 43.04 ^s 222.79	6 01 08.4 ["] 1394.0	.992 0376 2611	16 08.89	12 11 26.78 ^s - 13.97
7	23 07 25.83 ^s 222.39	-5 37 54.4 ["] +1398.7	0.992 2987 +2626	16 08.64	12 11 12.81 ^s - 14.37
8	23 11 08.22 ^s 221.00	5 14 35.7 ["] 1403.0	.992 5613 2636	16 08.38	12 10 58.44 ^s - 14.74
9	23 14 50.22 ^s 221.63	4 51 12.7 ["] 1406.7	.992 8249 2645	16 08.13	12 10 43.70 ^s - 15.09
10	23 18 31.85 ^s 221.27	4 27 46.0 ["] 1410.2	.993 0894 2654	16 07.87	12 10 28.61 ^s - 15.45
11	23 22 13.12 ^s 220.94	4 04 15.8 ["] 1413.3	.993 3548 2661	16 07.61	12 10 13.16 ^s - 15.76
12	23 25 54.06 ^s 220.63	-3 40 42.5 ["] +1415.8	0.993 6209 +2667	16 07.35	12 09 57.40 ^s - 16.08
13	23 29 34.69 ^s 220.32	3 17 06.7 ["] 1418.2	.993 8876 2674	16 07.09	12 09 41.32 ^s - 16.36
14	23 33 15.01 ^s 220.05	2 53 28.5 ["] 1420.0	.994 1550 2679	16 06.83	12 09 24.96 ^s - 16.63
15	23 36 55.06 ^s 219.79	2 29 48.5 ["] 1421.4	.994 4229 2687	16 06.57	12 09 08.33 ^s - 16.89
16	23 40 34.85 ^s 219.54	2 06 07.1 ["] 1422.6	.994 6916 2693	16 06.31	12 08 51.44 ^s - 17.13
17	23 44 14.39 ^s 219.32	-1 42 24.5 ["] +1423.2	0.994 9609 +2702	16 06.05	12 08 34.31 ^s - 17.34
18	23 47 53.71 ^s 219.11	1 18 41.3 ["] 1423.5	.995 2311 2711	16 05.79	12 08 16.97 ^s - 17.53
19	23 51 32.82 ^s 218.93	0 54 57.8 ["] 1423.5	.995 5022 2723	16 05.52	12 07 59.44 ^s - 17.72
20	23 55 11.75 ^s 218.76	0 31 14.3 ["] 1422.9	.995 7745 2738	16 05.26	12 07 41.72 ^s - 17.87
21	23 58 50.51 ^s 218.62	-0 07 31.4 ["] 1422.1	.996 0483 2752	16 04.99	12 07 23.85 ^s - 18.01
22	0 02 29.13 ^s 218.48	+0 16 10.7 ["] +1421.0	0.996 3235 +2771	16 04.73	12 07 05.84 ^s - 18.12
23	0 06 07.61 ^s 218.38	0 39 51.7 ["] 1419.4	.996 6006 2792	16 04.46	12 06 47.72 ^s - 18.21
24	0 09 45.99 ^s 218.30	1 03 31.1 ["] 1417.5	.996 8798 2814	16 04.19	12 06 29.51 ^s - 18.28
25	0 13 24.29 ^s 218.24	1 27 08.6 ["] 1415.3	.997 1612 2836	16 03.92	12 06 11.23 ^s - 18.31
26	0 17 02.53 ^s 218.22	1 50 43.9 ["] 1412.8	.997 4448 2859	16 03.64	12 05 52.92 ^s - 18.34
27	0 20 40.75 ^s 218.21	+2 14 16.7 ["] +1410.0	0.997 7307 +2880	16 03.37	12 05 34.58 ^s - 18.32
28	0 24 18.96 ^s 218.24	2 37 46.7 ["] 1406.8	.998 0187 2900	16 03.09	12 05 16.26 ^s - 18.29
29	0 27 57.20 ^s 218.29	3 01 13.5 ["] 1403.5	.998 3087 2916	16 02.81	12 04 57.97 ^s - 18.24
30	0 31 35.49 ^s 218.36	3 24 37.0 ["] 1399.7	.998 6003 2927	16 02.53	12 04 39.73 ^s - 18.15
31	0 35 13.85 ^s 218.44	3 47 56.7 ["] 1395.6	.998 8930 2936	16 02.25	12 04 21.58 ^s - 18.06
Apr. 1	0 38 52.29 ^s 218.55	+4 11 12.3 ["] +1391.1	0.999 1866 +2941	16 01.96	12 04 03.52 ^s - 17.94
2	0 42 30.84 ^s	+4 34 23.4 ["]	0.999 4807	16 01.68	12 03 45.58 ^s

SUN, 1967

FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967.0	1950.0	Date				
									23° 26'
Apr. 1	10 34 43.3	-18.9	-0.40	-2.60	-0.37	8.81	+12.382	-10.805	44.349
2	11 33 55.5 ^{3552.2}	18.7	.48	2.81	.45	8.80	12.520	10.725	44.352
3	12 33 05.9 ^{3550.4}	18.5	.53	2.99	.49	8.80	12.657	10.672	44.372
4	13 32 14.6 ^{3548.7}	18.3	.54	3.14	.51	8.80	12.795	10.658	44.405
5	14 31 21.5 ^{3546.9}	18.2	.54	3.26	.50	8.80	12.932	10.685	44.442
6	15 30 26.5 ^{3545.0}	-18.1	-0.50	-3.35	-0.45	8.79	+13.070	-10.754	44.475
7	16 29 29.7 ^{3543.2}	18.1	.43	3.41	.38	8.79	13.208	10.856	44.499
8	17 28 31.1 ^{3541.4}	18.1	.34	3.45	.30	8.79	13.345	10.979	44.510
9	18 27 30.4 ^{3539.3}	18.1	.24	3.47	.19	8.79	13.483	11.108	44.503
10	19 26 27.9 ^{3537.5}	18.0	-.12	3.48	-.06	8.78	13.621	11.230	44.479
11	20 25 23.3 ^{3535.4}	-18.0	+0.01	-3.47	+0.07	8.78	+13.758	-11.329	44.440
12	21 24 16.6 ^{3533.3}	17.9	.14	3.46	.20	8.78	13.896	11.392	44.392
13	22 23 07.8 ^{3531.2}	17.8	.27	3.46	.34	8.78	14.034	11.418	44.340
14	23 21 56.9 ^{3529.1}	17.6	.39	3.46	.46	8.77	14.171	11.403	44.291
15	24 20 43.9 ^{3527.0}	17.4	.50	3.47	.56	8.77	14.309	11.351	44.254
16	25 19 28.6 ^{3524.7}	-17.2	+0.58	-3.51	+0.65	8.77	+14.446	-11.277	44.234
17	26 18 11.1 ^{3522.5}	17.0	.63	3.57	.71	8.77	14.584	11.195	44.232
18	27 16 51.3 ^{3520.2}	16.8	.66	3.66	.73	8.76	14.722	11.125	44.251
19	28 15 29.3 ^{3518.0}	16.6	.65	3.78	.73	8.76	14.859	11.087	44.286
20	29 14 05.1 ^{3515.8}	16.5	.61	3.93	.69	8.76	14.997	11.096	44.328
21	30 12 38.6 ^{3513.5}	-16.4	+0.54	-4.12	+0.63	8.76	+15.135	-11.156	44.364
22	31 11 10.0 ^{3511.4}	16.4	.44	4.32	.53	8.76	15.272	11.258	44.380
23	32 09 39.3 ^{3509.3}	16.3	.32	4.55	.41	8.75	15.410	11.372	44.367
24	33 08 06.6 ^{3507.3}	16.3	.19	4.80	.28	8.75	15.548	11.463	44.325
25	34 06 31.9 ^{3505.3}	16.2	+.05	5.04	.14	8.75	15.685	11.505	44.261
26	35 04 55.5 ^{3503.6}	-16.0	-0.09	-5.28	+0.01	8.75	+15.823	-11.480	44.191
27	36 03 17.3 ^{3501.8}	15.8	.22	5.52	-.12	8.74	15.961	11.398	44.130
28	37 01 37.5 ^{3500.2}	15.5	.33	5.73	.23	8.74	16.098	11.281	44.090
29	37 59 56.1 ^{3498.6}	15.3	.41	5.91	.31	8.74	16.236	11.159	44.074
30	38 58 13.2 ^{3497.1}	15.0	.47	6.06	.36	8.74	16.373	11.056	44.080
May 1	39 56 28.7 ^{3495.5}	-14.8	-0.50	-6.19	-0.39	8.73	+16.511	-10.993	44.102
2	40 54 42.8 ^{3494.1}	14.6	.50	6.28	.38	8.73	16.649	10.973	44.128
3	41 52 55.4 ^{3492.6}	14.5	.46	6.34	.35	8.73	16.786	10.998	44.156
4	42 51 06.5 ^{3491.1}	14.4	.40	6.37	.28	8.73	16.924	11.060	44.176
5	43 49 16.1 ^{3489.6}	14.4	.32	6.38	.20	8.73	17.062	11.145	44.182
6	44 47 24.2 ^{3488.1}	-14.3	-0.22	-6.36	-0.09	8.72	+17.199	-11.241	44.172
7	45 45 30.8 ^{3486.6}	14.3	-.10	6.33	+.03	8.72	17.337	11.332	44.145
8	46 43 35.9 ^{3485.1}	14.2	+.03	6.28	.16	8.72	17.475	11.403	44.104
9	47 41 39.4 ^{3483.5}	14.1	.16	6.23	.30	8.72	17.612	11.442	44.051
10	48 39 41.4 ^{3482.0}	14.0	.29	6.18	.43	8.72	17.750	11.442	43.994
11	49 37 41.7 ^{3480.3}	-13.8	+0.42	-6.14	+0.56	8.71	+17.887	-11.400	43.940
12	50 35 40.3 ^{3478.6}	13.6	.53	6.11	.67	8.71	18.025	11.320	43.895
13	51 33 37.4 ^{3477.1}	13.3	.61	6.09	.76	8.71	18.163	11.212	43.866
14	52 31 32.6 ^{3475.2}	13.0	.68	6.10	.82	8.71	18.300	11.096	43.857
15	53 29 26.2 ^{3473.6}	12.8	.71	6.14	.86	8.71	18.438	10.988	43.869
16	54 27 18.0 ^{3471.8}	-12.6	+0.72	-6.20	+0.87	8.70	+18.576	-10.909	43.895
17	55 25 08.1 ^{3470.1}	-12.4	+0.69	-6.30	+0.84	8.70	+18.713	-10.873	43.933

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
Apr. 1	0 38 52.29 ^s 218.55	+ 4 11 12.3 ["] +1391.1	0.999 1866 +2941	16 01.96	12 04 03.52 ^s - 17.94
2	0 42 30.84 ^s 218.68	4 34 23.4 1386.3	.999 4807 +2940	16 01.68	12 03 45.58 ^s 17.81
3	0 46 09.52 ^s 218.82	4 57 29.7 1381.2	0.999 7747 2937	16 01.40	12 03 27.77 ^s 17.66
4	0 49 48.34 ^s 218.98	5 20 30.9 1375.6	1.000 0684 2931	16 01.11	12 03 10.11 ^s 17.48
5	0 53 27.32 ^s 219.16	5 43 26.5 1369.7	.000 3615 2920	16 00.83	12 02 52.63 ^s 17.29
6	0 57 06.48 ^s 219.35	+ 6 06 16.2 +1363.5	1.000 6535 +2909	16 00.55	12 02 35.34 ^s - 17.10
7	1 00 45.83 ^s 219.56	6 28 59.7 1356.9	.000 9444 2895	16 00.27	12 02 18.24 ^s 16.87
8	1 04 25.39 ^s 219.78	6 51 36.6 1349.9	.001 2339 2879	16 00.00	12 02 01.37 ^s 16.64
9	1 08 05.17 ^s 220.03	7 14 06.5 1342.5	.001 5218 2861	15 59.72	12 01 44.73 ^s 16.39
10	1 11 45.20 ^s 220.28	7 36 29.0 1334.9	.001 8079 2844	15 59.45	12 01 28.34 ^s 16.13
11	1 15 25.48 ^s 220.56	+ 7 58 43.9 +1326.9	1.002 0923 +2825	15 59.17	12 01 12.21 ^s - 15.85
12	1 19 06.04 ^s 220.85	8 20 50.8 1318.4	.002 3748 2805	15 58.90	12 00 56.36 ^s 15.56
13	1 22 46.89 ^s 221.14	8 42 49.2 1309.6	.002 6553 2786	15 58.63	12 00 40.80 ^s 15.25
14	1 26 28.03 ^s 221.46	9 04 38.8 1300.6	.002 9339 2767	15 58.37	12 00 25.55 ^s 14.94
15	1 30 09.49 ^s 221.78	9 26 19.4 1291.0	.003 2106 2749	15 58.10	12 00 10.61 ^s 14.60
16	1 33 51.27 ^s 222.13	+ 9 47 50.4 +1281.3	1.003 4855 +2733	15 57.84	11 59 56.01 ^s - 14.27
17	1 37 33.40 ^s 222.47	10 09 11.7 1271.0	.003 7588 2719	15 57.58	11 59 41.74 ^s 13.90
18	1 41 15.87 ^s 222.84	10 30 22.7 1260.5	.004 0307 2706	15 57.32	11 59 27.84 ^s 13.53
19	1 44 58.71 ^s 223.21	10 51 23.2 1249.5	.004 3013 2696	15 57.06	11 59 14.31 ^s 13.15
20	1 48 41.92 ^s 223.60	11 12 12.7 1238.4	.004 5709 2690	15 56.81	11 59 01.16 ^s 12.74
21	1 52 25.52 ^s 224.01	+11 32 51.1 +1226.9	1.004 8399 +2685	15 56.55	11 58 48.42 ^s - 12.33
22	1 56 09.53 ^s 224.44	11 53 18.0 1215.1	.005 1084 2681	15 56.29	11 58 36.09 ^s 11.89
23	1 59 53.97 ^s 224.88	12 13 33.1 1202.9	.005 3765 2680	15 56.04	11 58 24.20 ^s 11.44
24	2 03 38.85 ^s 225.34	12 33 36.0 1190.6	.005 6445 2679	15 55.79	11 58 12.76 ^s 10.97
25	2 07 24.19 ^s 225.82	12 53 26.6 1177.9	.005 9124 2676	15 55.53	11 58 01.79 ^s 10.49
26	2 11 10.01 ^s 226.32	+13 13 04.5 +1164.9	1.006 1800 +2672	15 55.28	11 57 51.30 ^s - 9.99
27	2 14 56.33 ^s 226.83	13 32 29.4 1151.7	.006 4472 2666	15 55.02	11 57 41.31 ^s 9.48
28	2 18 43.16 ^s 227.34	13 51 41.1 1138.1	.006 7138 2655	15 54.77	11 57 31.83 ^s 8.96
29	2 22 30.50 ^s 227.87	14 10 39.2 1124.2	.006 9793 2640	15 54.52	11 57 22.87 ^s 8.42
30	2 26 18.37 ^s 228.41	14 29 23.4 1110.1	.007 2433 2623	15 54.27	11 57 14.45 ^s 7.87
May 1	2 30 06.78 ^s 228.96	+14 47 53.5 +1095.4	1.007 5056 +2601	15 54.02	11 57 06.58 ^s - 7.33
2	2 33 55.74 ^s 229.51	15 06 08.9 1080.7	.007 7657 2576	15 53.77	11 56 59.25 ^s 6.77
3	2 37 45.25 ^s 230.06	15 24 09.6 1065.4	.008 0233 2547	15 53.53	11 56 52.48 ^s 6.20
4	2 41 35.31 ^s 230.63	15 41 55.0 1049.9	.008 2780 2518	15 53.29	11 56 46.28 ^s 5.64
5	2 45 25.94 ^s 231.20	15 59 24.9 1034.1	.008 5298 2485	15 53.05	11 56 40.64 ^s 5.07
6	2 49 17.14 ^s 231.77	+16 16 39.0 +1017.9	1.008 7783 +2448	15 52.82	11 56 35.57 ^s - 4.49
7	2 53 08.91 ^s 232.34	16 33 36.9 1001.4	.009 0231 2412	15 52.58	11 56 31.08 ^s 3.92
8	2 57 01.25 ^s 232.92	16 50 18.3 984.6	.009 2643 2372	15 52.36	11 56 27.16 ^s 3.35
9	3 00 54.17 ^s 233.50	17 06 42.9 967.5	.009 5015 2331	15 52.13	11 56 23.81 ^s 2.77
10	3 04 47.67 ^s 234.07	17 22 50.4 950.0	.009 7346 2290	15 51.91	11 56 21.04 ^s 2.21
11	3 08 41.74 ^s 234.65	+17 38 40.4 + 932.3	1.009 9636 +2249	15 51.70	11 56 18.83 ^s - 1.63
12	3 12 36.39 ^s 235.21	17 54 12.7 914.2	.010 1885 2207	15 51.49	11 56 17.20 ^s 1.07
13	3 16 31.60 ^s 235.77	18 09 26.9 895.9	.010 4092 2165	15 51.28	11 56 16.13 ^s - 0.51
14	3 20 27.37 ^s 236.33	18 24 22.8 877.3	.010 6257 2125	15 51.07	11 56 15.62 ^s + 0.05
15	3 24 23.70 ^s 236.89	18 39 00.1 858.2	.010 8382 2087	15 50.87	11 56 15.67 ^s + 0.59
16	3 28 20.59 ^s 237.43	+18 53 18.3 + 839.0	1.011 0469 +2050	15 50.68	11 56 16.26 ^s + 1.15
17	3 32 18.02 ^s	+19 07 17.3	1.011 2519	15 50.49	11 56 17.41 ^s

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic 23° 26'
			1967.0	1950.0	Date				
May 17	55° 25' 08".1 3468.3	-12.4	+0.69	-6.30	+0.84	8.70	+18.713	-10.873	43.933
18	56 22 56.4 3466.6	12.3	.63	6.42	.78	8.70	18.851	10.885	43.968
19	57 20 43.0 3464.9	12.2	.54	6.58	.69	8.70	18.989	10.938	43.990
20	58 18 27.9 3463.3	12.1	.42	6.75	.58	8.70	19.126	11.014	43.988
21	59 16 11.2 3461.7	12.0	.29	6.94	.46	8.70	19.264	11.082	43.958
22	60 13 52.9 3460.3	-11.9	+0.15	-7.14	+0.32	8.69	+19.401	-11.111	43.904
23	61 11 33.2 3458.9	11.8	+ .01	7.33	.18	8.69	19.539	11.079	43.836
24	62 09 12.1 3457.7	11.5	- .12	7.51	+ .05	8.69	19.677	10.984	43.772
25	63 06 49.8 3456.5	11.2	.24	7.68	- .06	8.69	19.814	10.840	43.725
26	64 04 26.3 3455.4	10.9	.33	7.82	.16	8.69	19.952	10.675	43.702
27	65 02 01.7 3454.5	-10.6	-0.40	-7.94	-0.22	8.69	+20.090	-10.522	43.703
28	65 59 36.2 3453.5	10.4	.44	8.02	.26	8.68	20.227	10.401	43.726
29	66 57 09.7 3452.7	10.2	.45	8.07	.26	8.68	20.365	10.326	43.759
30	67 54 42.4 3451.8	10.0	.42	8.09	.24	8.68	20.503	10.299	43.794
31	68 52 14.2 3451.0	9.9	.37	8.07	.19	8.68	20.640	10.315	43.823
June 1	69 49 45.2 3450.2	- 9.8	-0.30	-8.03	-0.11	8.68	+20.778	-10.361	43.841
2	70 47 15.4 3449.4	9.7	.20	7.97	- .01	8.68	20.915	10.422	43.842
3	71 44 44.8 3448.7	9.6	- .10	7.89	+ .10	8.68	21.053	10.483	43.827
4	72 42 13.5 3447.9	9.5	+ .03	7.80	.22	8.67	21.191	10.528	43.798
5	73 39 41.4 3447.0	9.4	.15	7.70	.35	8.67	21.328	10.547	43.756
6	74 37 08.4 3446.3	- 9.2	+0.28	-7.60	+0.48	8.67	+21.466	-10.527	43.709
7	75 34 34.7 3445.5	9.0	.40	7.50	.60	8.67	21.604	10.465	43.661
8	76 32 00.2 3444.7	8.8	.51	7.41	.71	8.67	21.741	10.363	43.622
9	77 29 24.9 3443.7	8.5	.61	7.33	.81	8.67	21.879	10.231	43.599
10	78 26 48.6 3442.9	8.2	.68	7.28	.88	8.67	22.017	10.085	43.595
11	79 24 11.5 3442.0	- 8.0	+0.72	-7.25	+0.93	8.67	+22.154	- 9.944	43.613
12	80 21 33.5 3441.0	7.7	.73	7.25	.94	8.67	22.292	9.831	43.648
13	81 18 54.5 3440.1	7.5	.71	7.28	.92	8.67	22.430	9.760	43.695
14	82 16 14.6 3439.1	7.3	.66	7.34	.87	8.66	22.567	9.738	43.742
15	83 13 33.7 3438.2	7.2	.57	7.42	.79	8.66	22.705	9.761	43.779
16	84 10 51.9 3437.3	- 7.1	+0.47	-7.54	+0.68	8.66	+22.842	- 9.811	43.795
17	85 08 09.2 3436.4	7.0	.34	7.66	.56	8.66	22.980	9.864	43.786
18	86 05 25.6 3435.5	6.9	.21	7.79	.42	8.66	23.118	9.889	43.753
19	87 02 41.1 3434.9	6.8	+ .07	7.93	.29	8.66	23.255	9.863	43.704
20	87 59 56.0 3434.2	6.5	- .07	8.05	.15	8.66	23.393	9.777	43.653
21	88 57 10.2 3433.7	- 6.2	-0.18	-8.16	+0.04	8.66	+23.531	- 9.637	43.611
22	89 54 23.9 3433.2	5.9	.28	8.25	- .06	8.66	23.668	9.464	43.593
23	90 51 37.1 3432.9	5.6	.36	8.31	.13	8.66	23.806	9.288	43.600
24	91 48 50.0 3432.7	5.3	.40	8.34	.18	8.66	23.944	9.137	43.628
25	92 46 02.7 3432.5	5.1	.41	8.33	.19	8.66	24.081	9.029	43.674
26	93 43 15.2 3432.4	- 4.9	-0.40	-8.30	-0.17	8.66	+24.219	- 8.971	43.726
27	94 40 27.6 3432.5	4.7	.35	8.23	.13	8.66	24.356	8.961	43.774
28	95 37 40.1 3432.4	4.6	.29	8.14	- .06	8.66	24.494	8.989	43.810
29	96 34 52.5 3432.5	4.5	.20	8.02	+ .03	8.66	24.632	9.037	43.833
30	97 32 05.0 3432.6	4.5	- .09	7.89	.13	8.66	24.769	9.093	43.839
July 1	98 29 17.6 3432.7	- 4.4	+0.02	-7.74	+0.25	8.66	+24.907	- 9.140	43.829
2	99 26 30.3	- 4.2	+0.15	-7.59	+0.37	8.66	+25.045	- 9.163	43.805

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
May 17	3 32 18.02	+19 07 17.3	1.011 2519	15 50.49	11 56 17.41
18	3 36 15.99 ^{237.97}	19 20 56.7 ^{+ 819.4}	.011 4536 ⁺²⁰¹⁷	15 50.30	11 56 19.09 ^{+ 1.68}
19	3 40 14.49 ^{238.50}	19 34 16.4 ^{799.7}	.011 6522 ¹⁹⁸⁶	15 50.11	11 56 21.31 ^{2.22}
20	3 44 13.53 ^{239.04}	19 47 16.0 ^{779.6}	.011 8479 ¹⁹⁵⁷	15 49.93	11 56 24.06 ^{2.75}
21	3 48 13.10 ^{239.57}	19 59 55.3 ^{759.3}	.012 0412 ¹⁹³³	15 49.74	11 56 27.34 ^{3.28}
	240.10	738.7	1909		3.81
22	3 52 13.20 ^{240.63}	+20 12 14.0 ^{+ 718.1}	1.012 2321 ⁺¹⁸⁸⁹	15 49.56	11 56 31.15 ^{+ 4.33}
23	3 56 13.83 ^{241.15}	20 24 12.1 ^{697.1}	.012 4210 ¹⁸⁶⁷	15 49.39	11 56 35.48 ^{4.85}
24	4 00 14.98 ^{241.67}	20 35 49.2 ^{676.0}	.012 6077 ¹⁸⁴⁵	15 49.21	11 56 40.33 ^{5.36}
25	4 04 16.65 ^{242.18}	20 47 05.2 ^{654.6}	.012 7922 ¹⁸²³	15 49.04	11 56 45.69 ^{5.87}
26	4 08 18.83 ^{242.68}	20 57 59.8 ^{633.0}	.012 9745 ¹⁷⁹⁹	15 48.87	11 56 51.56 ^{6.37}
27	4 12 21.51 ^{243.19}	+21 08 32.8 ^{+ 611.2}	1.013 1544 ⁺¹⁷⁷⁰	15 48.70	11 56 57.93 ^{+ 6.86}
28	4 16 24.70 ^{243.66}	21 18 44.0 ^{589.2}	.013 3314 ¹⁷⁴¹	15 48.53	11 57 04.79 ^{7.34}
29	4 20 28.36 ^{244.14}	21 28 33.2 ^{567.0}	.013 5055 ¹⁷⁰⁵	15 48.37	11 57 12.13 ^{7.82}
30	4 24 32.50 ^{244.60}	21 38 00.2 ^{544.6}	.013 6760 ¹⁶⁶⁹	15 48.21	11 57 19.95 ^{8.27}
31	4 28 37.10 ^{245.04}	21 47 04.8 ^{521.9}	.013 8429 ¹⁶²⁹	15 48.06	11 57 28.22 ^{8.70}
June 1	4 32 42.14 ^{245.47}	+21 55 46.7 ^{+ 499.0}	1.014 0058 ⁺¹⁵⁸⁶	15 47.90	11 57 36.92 ^{+ 9.13}
2	4 36 47.61 ^{245.89}	22 04 05.7 ^{476.0}	.014 1644 ¹⁵⁴¹	15 47.76	11 57 46.05 ^{9.54}
3	4 40 53.50 ^{246.29}	22 12 01.7 ^{452.9}	.014 3185 ¹⁴⁹³	15 47.61	11 57 55.59 ^{9.93}
4	4 44 59.79 ^{246.66}	22 19 34.6 ^{429.4}	.014 4678 ¹⁴⁴²	15 47.47	11 58 05.52 ^{10.29}
5	4 49 06.45 ^{247.03}	22 26 44.0 ^{405.8}	.014 6120 ¹³⁹¹	15 47.34	11 58 15.81 ^{10.64}
6	4 53 13.48 ^{247.36}	+22 33 29.8 ^{+ 382.2}	1.014 7511 ⁺¹³³⁷	15 47.21	11 58 26.45 ^{+ 10.97}
7	4 57 20.84 ^{247.68}	22 39 52.0 ^{358.3}	.014 8848 ¹²⁸²	15 47.08	11 58 37.42 ^{11.26}
8	5 01 28.52 ^{247.97}	22 45 50.3 ^{334.3}	.015 0130 ¹²²⁵	15 46.96	11 58 48.68 ^{11.55}
9	5 05 36.49 ^{248.24}	22 51 24.6 ^{310.2}	.015 1355 ¹¹⁶⁷	15 46.85	11 59 00.23 ^{11.80}
10	5 09 44.73 ^{248.47}	22 56 34.8 ^{286.0}	.015 2522 ¹¹¹²	15 46.74	11 59 12.03 ^{12.02}
11	5 13 53.20 ^{248.69}	+23 01 20.8 ^{+ 261.6}	1.015 3634 ⁺¹⁰⁵⁵	15 46.64	11 59 24.05 ^{+ 12.22}
12	5 18 01.89 ^{248.87}	23 05 42.4 ^{237.1}	.015 4680 ¹⁰⁰²	15 46.54	11 59 36.27 ^{12.40}
13	5 22 10.76 ^{249.04}	23 09 39.5 ^{212.6}	.015 5691 ⁹⁴⁸	15 46.44	11 59 48.67 ^{12.55}
14	5 26 19.80 ^{249.17}	23 13 12.1 ^{188.1}	.015 6639 ⁸⁹⁹	15 46.36	12 00 01.22 ^{12.68}
15	5 30 28.97 ^{249.28}	23 16 20.2 ^{163.3}	.015 7538 ⁸⁵³	15 46.27	12 00 13.90 ^{12.78}
16	5 34 38.25 ^{249.37}	+23 19 03.5 ^{+ 138.6}	1.015 8391 ^{+ 808}	15 46.19	12 00 26.68 ^{+ 12.86}
17	5 38 47.62 ^{249.44}	23 21 22.1 ^{113.8}	.015 9199 ⁷⁶⁸	15 46.12	12 00 39.54 ^{12.91}
18	5 42 57.06 ^{249.49}	23 23 15.9 ^{89.0}	.015 9967 ⁷³¹	15 46.05	12 00 52.45 ^{12.96}
19	5 47 06.55 ^{249.53}	23 24 44.9 ^{64.3}	.016 0698 ⁶⁹⁶	15 45.98	12 01 05.41 ^{12.97}
20	5 51 16.08 ^{249.53}	23 25 49.2 ^{39.5}	.016 1394 ⁶⁶²	15 45.91	12 01 18.38 ^{12.97}
21	5 55 25.61 ^{249.53}	+23 26 28.7 ^{+ 14.7}	1.016 2056 ^{+ 631}	15 45.85	12 01 31.35 ^{+ 12.95}
22	5 59 35.14 ^{249.50}	23 26 43.4 ^{- 10.0}	.016 2687 ⁵⁹⁸	15 45.79	12 01 44.30 ^{12.92}
23	6 03 44.64 ^{249.45}	23 26 33.4 ^{34.7}	.016 3285 ⁵⁶⁷	15 45.74	12 01 57.22 ^{12.86}
24	6 07 54.09 ^{249.39}	23 25 58.7 ^{59.4}	.016 3852 ⁵³³	15 45.68	12 02 10.08 ^{12.78}
25	6 12 03.48 ^{249.29}	23 24 59.3 ^{84.1}	.016 4385 ⁴⁹⁷	15 45.64	12 02 22.86 ^{12.68}
26	6 16 12.77 ^{249.18}	+23 23 35.2 ^{- 108.8}	1.016 4882 ^{+ 459}	15 45.59	12 02 35.54 ^{+ 12.56}
27	6 20 21.95 ^{249.04}	23 21 46.4 ^{133.4}	.016 5341 ⁴¹⁸	15 45.55	12 02 48.10 ^{12.43}
28	6 24 30.99 ^{248.90}	23 19 33.0 ^{158.0}	.016 5759 ³⁷⁵	15 45.51	12 03 00.53 ^{12.26}
29	6 28 39.89 ^{248.73}	23 16 55.0 ^{182.5}	.016 6134 ³²⁸	15 45.47	12 03 12.79 ^{12.08}
30	6 32 48.62 ^{248.53}	23 13 52.5 ^{207.0}	.016 6462 ²⁸⁰	15 45.44	12 03 24.87 ^{11.88}
July 1	6 36 57.15 ^{248.32}	+23 10 25.5 ^{- 231.3}	1.016 6742 ^{+ 230}	15 45.42	12 03 36.75 ^{+ 11.64}
2	6 41 05.47	+23 06 34.2	1.016 6972	15 45.39	12 03 48.39

FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic 23° 26'
			1967.0	1950.0	Date				
July	1 98° 29' 17.6 ^{3432.7}	- 4.4	+0.02	-7.74	+0.25	8.66	+24.907	- 9.140	43.829
	2 99 26 30.3 ^{3432.8}	4.2	.15	7.59	.37	8.66	25.045	9.163	43.805
	3 100 23 43.1 ^{3433.0}	4.1	.27	7.43	.50	8.66	25.182	9.150	43.775
	4 101 20 56.1 ^{3433.2}	3.9	.39	7.28	.61	8.66	25.320	9.099	43.742
	5 102 18 09.3 ^{3433.3}	3.7	.49	7.13	.72	8.66	25.458	9.007	43.715
	6 103 15 22.6 ^{3433.4}	- 3.4	+0.59	-6.99	+0.81	8.66	+25.595	- 8.881	43.702
	7 104 12 36.0 ^{3433.5}	3.1	.66	6.88	.88	8.66	25.733	8.736	43.707
	8 105 09 49.5 ^{3433.7}	2.9	.70	6.79	.93	8.66	25.870	8.590	43.736
	9 106 07 03.2 ^{3433.6}	2.6	.72	6.73	.94	8.66	26.008	8.466	43.783
	10 107 04 16.8 ^{3433.7}	2.4	.70	6.69	.93	8.66	26.146	8.385	43.845
	11 108 01 30.5 ^{3433.6}	- 2.2	+0.66	-6.68	+0.88	8.66	+26.283	- 8.356	43.910
	12 108 58 44.1 ^{3433.6}	2.1	.58	6.70	.81	8.66	26.421	8.376	43.964
	13 109 55 57.7 ^{3433.6}	2.0	.48	6.75	.71	8.66	26.559	8.431	44.000
	14 110 53 11.3 ^{3433.6}	1.9	.36	6.81	.59	8.66	26.696	8.495	44.011
	15 111 50 24.9 ^{3433.5}	1.8	.23	6.88	.45	8.66	26.834	8.540	43.998
	16 112 47 38.4 ^{3433.7}	- 1.7	+0.09	-6.96	+0.32	8.66	+26.972	- 8.541	43.968
	17 113 44 52.1 ^{3433.7}	1.5	.04	7.03	.18	8.66	27.109	8.487	43.932
	18 114 42 05.8 ^{3433.9}	1.3	.16	7.08	+ .06	8.66	27.247	8.381	43.903
	19 115 39 19.7 ^{3434.3}	1.0	.26	7.12	- .04	8.66	27.385	8.238	43.890
	20 116 36 34.0 ^{3434.5}	0.7	.34	7.12	.12	8.66	27.522	8.081	43.902
	21 117 33 48.5 ^{3435.1}	- 0.4	-0.39	-7.10	-0.17	8.66	+27.660	- 7.940	43.939
	22 118 31 03.6 ^{3435.6}	- 0.2	.41	7.05	.19	8.66	27.797	7.835	43.992
	23 119 28 19.2 ^{3436.3}	0.0	.40	6.96	.18	8.66	27.935	7.778	44.056
	24 120 25 35.5 ^{3437.0}	+ 0.2	.36	6.84	.14	8.66	28.073	7.772	44.119
	25 121 22 52.5 ^{3437.8}	0.3	.29	6.70	- .08	8.66	28.210	7.810	44.173
	26 122 20 10.3 ^{3438.7}	+ 0.3	-0.21	-6.53	0.00	8.66	+28.348	- 7.875	44.213
	27 123 17 29.0 ^{3439.6}	0.4	.10	6.35	+ .10	8.67	28.486	7.954	44.237
	28 124 14 48.6 ^{3440.6}	0.4	+ .01	6.15	.22	8.67	28.623	8.028	44.243
	29 125 12 09.2 ^{3441.6}	0.5	.13	5.95	.33	8.67	28.761	8.085	44.234
	30 126 09 30.8 ^{3442.7}	0.6	.25	5.74	.45	8.67	28.899	8.110	44.215
Aug.	31 127 06 53.5 ^{3443.7}	+ 0.8	+0.36	-5.53	+0.56	8.67	+29.036	- 8.099	44.193
	1 128 04 17.2 ^{3444.8}	1.0	.47	5.34	.67	8.67	29.174	8.049	44.175
	2 129 01 42.0 ^{3445.9}	1.2	.56	5.15	.76	8.67	29.311	7.962	44.166
	3 129 59 07.9 ^{3447.0}	1.4	.63	4.99	.83	8.67	29.449	7.850	44.174
	4 130 56 34.9 ^{3448.0}	1.7	.68	4.85	.87	8.67	29.587	7.730	44.203
	5 131 54 02.9 ^{3449.1}	+ 1.9	+0.69	-4.73	+0.88	8.67	+29.724	- 7.624	44.253
	6 132 51 32.0 ^{3450.1}	2.1	.68	4.65	.87	8.68	29.862	7.553	44.319
	7 133 49 02.1 ^{3451.0}	2.3	.64	4.59	.82	8.68	30.000	7.534	44.394
	8 134 46 33.1 ^{3452.0}	2.4	.57	4.56	.75	8.68	30.137	7.572	44.463
	9 135 44 05.1 ^{3452.8}	2.4	.47	4.55	.65	8.68	30.275	7.651	44.512
	10 136 41 37.9 ^{3453.7}	+ 2.5	+0.35	-4.56	+0.53	8.68	+30.413	- 7.748	44.536
	11 137 39 11.6 ^{3454.6}	2.5	.22	4.59	.39	8.68	30.550	7.832	44.533
	12 138 36 46.2 ^{3455.3}	2.6	+ .09	4.62	.25	8.68	30.688	7.878	44.510
	13 139 34 21.5 ^{3456.3}	2.8	- .05	4.64	+ .12	8.69	30.825	7.871	44.478
	14 140 31 57.8 ^{3457.1}	2.9	.17	4.65	- .01	8.69	30.963	7.810	44.451
	15 141 29 34.9 ^{3458.2}	+ 3.2	-0.27	-4.64	-0.12	8.69	+31.101	- 7.711	44.439
	16 142 27 13.1	+ 3.4	-0.35	-4.61	-0.20	8.69	+31.238	- 7.595	44.449

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
July	^h ^m ^s 6 36 57.15 ^s _{248.32}	[°] ['] [″] +23 10 25.5 - 231.3	I.016 6742 + 230	['] [″] 15 45.42	^h ^m ^s 12 03 36.75 + 11.64
	6 41 05.47 ^s _{248.07}	23 06 34.2 - 255.6	.016 6972 + 177	15 45.39	12 03 48.39 + 11.39
	6 45 13.54 ^s _{247.82}	23 02 18.6 - 279.8	.016 7149 + 122	15 45.38	12 03 59.78 + 11.12
	6 49 21.36 ^s _{247.54}	22 57 38.8 - 303.9	.016 7271 + 65	15 45.37	12 04 10.90 + 10.83
	6 53 28.90 ^s _{247.22}	22 52 34.9 - 327.7	.016 7336 + 7	15 45.36	12 04 21.73 + 10.50
	6 57 36.12 ^s _{246.90}	+22 47 07.2 - 351.6	I.016 7343 - 54	15 45.36	12 04 32.23 + 10.16
	7 01 43.02 ^s _{246.54}	22 41 15.6 - 375.2	.016 7289 + 116	15 45.37	12 04 42.39 + 9.79
	7 05 49.56 ^s _{246.16}	22 35 00.4 - 398.7	.016 7173 + 177	15 45.38	12 04 52.18 + 9.40
	7 09 55.72 ^s _{245.76}	22 28 21.7 - 422.0	.016 6996 + 240	15 45.39	12 05 01.58 + 8.98
	7 14 01.48 ^s _{245.33}	22 21 19.7 - 445.2	.016 6756 + 299	15 45.41	12 05 10.56 + 8.55
	7 18 06.81 ^s _{244.88}	+22 13 54.5 - 468.1	I.016 6457 - 359	15 45.44	12 05 19.11 + 8.10
	7 22 11.69 ^s _{244.41}	22 06 06.4 - 491.0	.016 6098 + 414	15 45.48	12 05 27.21 + 7.62
	7 26 16.10 ^s _{243.93}	21 57 55.4 - 513.5	.016 5684 + 467	15 45.51	12 05 34.83 + 7.13
	7 30 20.03 ^s _{243.43}	21 49 21.9 - 535.9	.016 5217 + 516	15 45.56	12 05 41.96 + 6.62
	7 34 23.46 ^s _{242.93}	21 40 26.0 - 558.1	.016 4701 + 562	15 45.61	12 05 48.58 + 6.11
	7 38 26.39 ^s _{242.40}	+21 31 07.9 - 580.1	I.016 4139 - 605	15 45.66	12 05 54.69 + 5.57
	7 42 28.79 ^s _{241.87}	21 21 27.8 - 601.7	.016 3534 + 644	15 45.71	12 06 00.26 + 5.04
	7 46 30.66 ^s _{241.34}	21 11 26.1 - 623.2	.016 2890 + 681	15 45.77	12 06 05.30 + 4.50
	7 50 32.00 ^s _{240.78}	21 01 02.9 - 644.5	.016 2209 + 715	15 45.84	12 06 09.80 + 3.94
	7 54 32.78 ^s _{240.23}	20 50 18.4 - 665.4	.016 1494 + 747	15 45.90	12 06 13.74 + 3.38
	7 58 33.01 ^s _{239.67}	+20 39 13.0 - 686.2	I.016 0747 - 780	15 45.97	12 06 17.12 + 2.83
	8 02 32.68 ^s _{239.10}	20 27 46.8 - 706.8	.015 9967 + 812	15 46.05	12 06 19.95 + 2.25
	8 06 31.78 ^s _{238.53}	20 16 00.0 - 727.0	.015 9155 + 844	15 46.12	12 06 22.20 + 1.69
	8 10 30.31 ^s _{237.96}	20 03 53.0 - 747.2	.015 8311 + 878	15 46.20	12 06 23.89 + 1.11
	8 14 28.27 ^s _{237.38}	19 51 25.8 - 767.0	.015 7433 + 913	15 46.28	12 06 25.00 + 0.54
	8 18 25.65 ^s _{236.80}	+19 38 38.8 - 786.6	I.015 6520 - 952	15 46.37	12 06 25.54 - 0.04
	8 22 22.45 ^s _{236.22}	19 25 32.2 - 806.0	.015 5568 + 990	15 46.46	12 06 25.50 - 0.62
	8 26 18.67 ^s _{235.65}	19 12 06.2 - 825.0	.015 4578 + 1031	15 46.55	12 06 24.88 - 1.20
	8 30 14.32 ^s _{235.05}	18 58 21.2 - 843.9	.015 3547 + 1074	15 46.64	12 06 23.68 - 1.80
	8 34 09.37 ^s _{234.47}	18 44 17.3 - 862.5	.015 2473 + 1119	15 46.74	12 06 21.88 - 2.38
	8 38 03.84 ^s _{233.89}	+18 29 54.8 - 880.8	I.015 1354 - 1166	15 46.85	12 06 19.50 - 2.97
Aug.	8 41 57.73 ^s _{233.30}	18 15 14.0 - 898.7	.015 0188 + 1215	15 46.96	12 06 16.53 - 3.56
	8 45 51.03 ^s _{232.70}	18 00 15.3 - 916.5	.014 8973 + 1266	15 47.07	12 06 12.97 - 4.16
	8 49 43.73 ^s _{232.11}	17 44 58.8 - 933.8	.014 7707 + 1319	15 47.19	12 06 08.81 - 4.75
	8 53 35.84 ^s _{231.52}	17 29 25.0 - 951.0	.014 6388 + 1375	15 47.31	12 06 04.06 - 5.34
	8 57 27.36 ^s _{230.92}	+17 13 34.0 - 967.8	I.014 5013 - 1430	15 47.44	12 05 58.72 - 5.95
	9 01 18.28 ^s _{230.31}	16 57 26.2 - 984.2	.014 3583 + 1486	15 47.57	12 05 52.77 - 6.55
	9 05 08.59 ^s _{229.71}	16 41 02.0 - 1000.4	.014 2097 + 1542	15 47.71	12 05 46.22 - 7.14
	9 08 58.30 ^s _{229.10}	16 24 21.6 - 1016.3	.014 0555 + 1597	15 47.86	12 05 39.08 - 7.75
	9 12 47.40 ^s _{228.51}	16 07 25.3 - 1031.8	.013 8958 + 1649	15 48.01	12 05 31.33 - 8.35
	9 16 35.91 ^s _{227.91}	+15 50 13.5 - 1047.0	I.013 7309 - 1697	15 48.16	12 05 22.98 - 8.93
	9 20 23.82 ^s _{227.32}	15 32 46.5 - 1061.8	.013 5612 + 1744	15 48.32	12 05 14.05 - 9.53
	9 24 11.14 ^s _{226.73}	15 15 04.7 - 1076.4	.013 3868 + 1785	15 48.48	12 05 04.52 - 10.11
	9 27 57.87 ^s _{226.17}	14 57 08.3 - 1090.7	.013 2083 + 1824	15 48.65	12 04 54.41 - 10.68
	9 31 44.04 ^s _{225.59}	14 38 57.6 - 1104.5	.013 0259 + 1857	15 48.82	12 04 43.73 - 11.25
	9 35 29.63 ^s _{225.04}	+14 20 33.1 - 1118.1	I.012 8402 - 1888	15 48.99	12 04 32.48 - 11.79
	9 39 14.67 ^s	+14 01 55.0	I.012 6514	15 49.17	12 04 20.69

SUN, 1967
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Date	Longitude Mean Equinox of 1967-0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic
			1967-0	1950-0	Date				
									23° 26'
Aug. 16	142° 27' 13.1 3459.1	+ 3.4	-0.35	-4.61	-0.20	8.69	+31.238	- 7.595	44.449
17	143 24 52.2 3460.3	3.7	.40	4.55	.25	8.69	31.376	7.487	44.479
18	144 22 32.5 3461.5	3.9	.43	4.45	.28	8.69	31.514	7.410	44.531
19	145 20 14.0 3462.7	4.0	.41	4.33	.27	8.70	31.651	7.378	44.594
20	146 17 56.7 3464.1	4.2	.38	4.17	.24	8.70	31.789	7.394	44.659
21	147 15 40.8 3465.6	+ 4.2	-0.31	-3.99	-0.18	8.70	+31.927	- 7.455	44.717
22	148 13 26.4 3467.1	4.3	.23	3.78	- .09	8.70	32.064	7.550	44.763
23	149 11 13.5 3468.6	4.3	.12	3.56	+ .01	8.70	32.202	7.663	44.791
24	150 09 02.1 3470.3	4.3	- .01	3.32	.12	8.70	32.339	7.777	44.801
25	151 06 52.4 3472.0	4.4	+ .12	3.07	.24	8.71	32.477	7.877	44.795
26	152 04 44.4 3473.7	+ 4.4	+0.25	-2.82	+0.36	8.71	+32.615	- 7.950	44.777
27	153 02 38.1 3475.5	4.5	.37	2.57	.48	8.71	32.752	7.987	44.752
28	154 00 33.6 3477.3	4.6	.48	2.34	.59	8.71	32.890	7.986	44.729
29	154 58 30.9 3479.2	4.8	.57	2.11	.68	8.71	33.028	7.949	44.713
30	155 56 30.1 3481.0	5.0	.65	1.91	.75	8.71	33.165	7.883	44.711
31	156 54 31.1 3482.9	+ 5.2	+0.70	-1.73	+0.80	8.72	+33.303	- 7.803	44.727
Sept. 1	157 52 34.0 3484.7	5.4	.73	1.57	.82	8.72	33.441	7.726	44.764
2	158 50 38.7 3486.6	5.6	.73	1.44	.81	8.72	33.578	7.673	44.819
3	159 48 45.3 3488.3	5.8	.69	1.35	.77	8.72	33.716	7.665	44.887
4	160 46 53.6 3490.1	5.8	.63	1.28	.71	8.73	33.854	7.713	44.953
5	161 45 03.7 3491.7	+ 5.9	+0.54	-1.24	+0.61	8.73	+33.991	- 7.810	45.006
6	162 43 15.4 3493.4	5.9	.43	1.22	.49	8.73	34.129	7.936	45.033
7	163 41 28.8 3494.9	5.9	.30	1.22	.36	8.73	34.266	8.060	45.029
8	164 39 43.7 3496.4	5.9	.16	1.22	.22	8.73	34.404	8.149	45.001
9	165 38 00.1 3498.0	6.0	+ .03	1.22	+ .08	8.74	34.542	8.183	44.959
10	166 36 18.1 3499.4	+ 6.2	-0.09	-1.21	-0.05	8.74	+34.679	- 8.159	44.917
11	167 34 37.5 3501.0	6.4	.20	1.18	.16	8.74	34.817	8.092	44.890
12	168 32 58.5 3502.4	6.6	.28	1.13	.25	8.74	34.955	8.002	44.884
13	169 31 20.9 3504.1	6.8	.34	1.05	.31	8.75	35.092	7.919	44.901
14	170 29 45.0 3505.7	7.0	.36	0.94	.34	8.75	35.230	7.860	44.936
15	171 28 10.7 3507.3	+ 7.2	-0.35	-0.79	-0.34	8.75	+35.368	- 7.844	44.985
16	172 26 38.0 3509.1	7.3	.31	0.62	.30	8.75	35.505	7.874	45.039
17	173 25 07.1 3510.9	7.3	.25	0.41	.24	8.75	35.643	7.950	45.088
18	174 23 38.0 3512.8	7.3	.16	-0.19	.16	8.76	35.780	8.061	45.124
19	175 22 10.8 3514.8	7.3	- .05	+0.06	- .05	8.76	35.918	8.193	45.144
20	176 20 45.6 3516.7	+ 7.3	+0.08	+0.32	+0.07	8.76	+36.056	- 8.329	45.146
21	177 19 22.3 3518.8	7.3	.21	0.58	.19	8.76	36.193	8.455	45.129
22	178 18 01.1 3520.9	7.4	.34	0.85	.32	8.77	36.331	8.555	45.100
23	179 16 42.0 3523.1	7.4	.47	1.12	.44	8.77	36.469	8.623	45.063
24	180 15 25.1 3525.2	7.6	.59	1.38	.56	8.77	36.606	8.652	45.025
25	181 14 10.3 3527.5	+ 7.7	+0.70	+1.62	+0.66	8.77	+36.744	- 8.643	44.990
26	182 12 57.8 3529.8	7.9	.79	1.85	.74	8.78	36.882	8.604	44.968
27	183 11 47.6 3532.0	8.1	.85	2.05	.80	8.78	37.019	8.545	44.963
28	184 10 39.6 3534.3	8.2	.89	2.22	.83	8.78	37.157	8.483	44.975
29	185 09 33.9 3536.6	8.4	.90	2.36	.83	8.78	37.294	8.435	45.008
30	186 08 30.5 3538.9	+ 8.6	+0.88	+2.47	+0.80	8.79	+37.432	- 8.420	45.054
Oct. 1	187 07 29.4	+ 8.7	+0.82	+2.55	+0.74	8.79	+37.570	- 8.455	45.105

To obtain the longitude referred to the mean equinox of 1950-0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
Aug. 16	9 39 14.67 ^s 224.50	+14 01 55.0 -1131.4	1.012 6514 -1916	15 49.17	12 04 20.69 ^s - 12.34
17	9 42 59.17 ^s 223.96	13 43 03.6 1144.3	.012 4598 1942	15 49.35	12 04 08.35 12.85
18	9 46 43.13 ^s 223.45	13 23 59.3 1156.9	.012 2656 1964	15 49.53	12 03 55.50 13.37
19	9 50 26.58 ^s 222.94	13 04 42.4 1169.3	.012 0692 1986	15 49.72	12 03 42.13 13.86
20	9 54 09.52 ^s 222.45	12 45 13.1 1181.4	.011 8706 2009	15 49.90	12 03 28.27 14.34
21	9 57 51.97 ^s 221.97	+12 25 31.7 -1193.2	1.011 6697 -2029	15 50.09	12 03 13.93 - 14.80
22	10 01 33.94 ^s 221.52	12 05 38.5 1204.7	.011 4668 2050	15 50.28	12 02 59.13 15.25
23	10 05 15.46 ^s 221.08	11 45 33.8 1215.9	.011 2618 2074	15 50.48	12 02 43.88 15.68
24	10 08 56.54 ^s 220.66	11 25 17.9 1226.8	.011 0544 2097	15 50.67	12 02 28.20 16.09
25	10 12 37.20 ^s 220.25	11 04 51.1 1237.4	.010 8447 2122	15 50.87	12 02 12.11 16.50
26	10 16 17.45 ^s 219.86	+10 44 13.7 -1247.8	1.010 6325 -2149	15 51.07	12 01 55.61 - 16.88
27	10 19 57.31 ^s 219.49	10 23 25.9 1257.7	.010 4176 2177	15 51.27	12 01 38.73 17.25
28	10 23 36.80 ^s 219.12	10 02 28.2 1267.4	.010 1999 2206	15 51.48	12 01 21.48 17.60
29	10 27 15.92 ^s 218.79	9 41 20.8 1276.8	.009 9793 2237	15 51.68	12 01 03.88 17.94
30	10 30 54.71 ^s 218.45	9 20 04.0 1285.9	.009 7556 2271	15 51.89	12 00 45.94 18.26
31	10 34 33.16 ^s 218.14	+ 8 58 38.1 -1294.5	1.009 5285 -2305	15 52.11	12 00 27.68 - 18.57
Sept. 1	10 38 11.30 ^s 217.83	8 37 03.6 1303.0	.009 2980 2343	15 52.33	12 00 09.11 18.87
2	10 41 49.13 ^s 217.55	8 15 20.6 1310.9	.009 0637 2383	15 52.55	11 59 50.24 19.14
3	10 45 26.68 ^s 217.27	7 53 29.7 1318.7	.008 8254 2423	15 52.77	11 59 31.10 19.41
4	10 49 03.95 ^s 217.00	7 31 31.0 1326.0	.008 5831 2464	15 53.00	11 59 11.69 19.67
5	10 52 40.95 ^s 216.76	+ 7 09 25.0 -1333.1	1.008 3367 -2504	15 53.23	11 58 52.02 - 19.90
6	10 56 17.71 ^s 216.52	6 47 11.9 1339.6	.008 0863 2543	15 53.47	11 58 32.12 20.13
7	10 59 54.23 ^s 216.31	6 24 52.3 1346.0	.007 8320 2579	15 53.71	11 58 11.99 20.35
8	11 03 30.54 ^s 216.10	6 02 26.3 1351.9	.007 5741 2613	15 53.95	11 57 51.64 20.54
9	11 07 06.64 ^s 215.91	5 39 54.4 1357.5	.007 3128 2641	15 54.20	11 57 31.10 20.73
10	11 10 42.55 ^s 215.75	+ 5 17 16.9 -1362.8	1.007 0487 -2667	15 54.45	11 57 10.37 - 20.88
11	11 14 18.30 ^s 215.60	4 54 34.1 1367.6	.006 7820 2688	15 54.71	11 56 49.49 21.03
12	11 17 53.90 ^s 215.47	4 31 46.5 1372.2	.006 5132 2704	15 54.96	11 56 28.46 21.14
13	11 21 29.37 ^s 215.35	4 08 54.3 1376.4	.006 2428 2718	15 55.22	11 56 07.32 21.25
14	11 25 04.72 ^s 215.26	3 45 57.9 1380.4	.005 9710 2728	15 55.47	11 55 46.07 21.33
15	11 28 39.98 ^s 215.20	+ 3 22 57.5 -1383.9	1.005 6982 -2736	15 55.73	11 55 24.74 - 21.37
16	11 32 15.18 ^s 215.14	2 59 53.6 1387.2	.005 4246 2740	15 55.99	11 55 03.37 21.41
17	11 35 50.32 ^s 215.13	2 36 46.4 1390.2	.005 1506 2745	15 56.25	11 54 41.96 21.43
18	11 39 25.45 ^s 215.12	2 13 36.2 1392.9	.004 8761 2747	15 56.52	11 54 20.53 21.40
19	11 43 00.57 ^s 215.15	1 50 23.3 1395.2	.004 6014 2749	15 56.78	11 53 59.13 21.37
20	11 46 35.72 ^s 215.20	+ 1 27 08.1 -1397.4	1.004 3265 -2750	15 57.04	11 53 37.76 - 21.31
21	11 50 10.92 ^s 215.28	1 03 50.7 1399.0	.004 0515 2752	15 57.30	11 53 16.45 21.23
22	11 53 46.20 ^s 215.37	0 40 31.7 1400.6	.003 7763 2753	15 57.56	11 52 55.22 21.12
23	11 57 21.57 ^s 215.49	+ 0 17 11.1 1401.7	.003 5010 2757	15 57.83	11 52 34.10 20.99
24	12 00 57.06 ^s 215.63	- 0 06 10.6 1402.5	.003 2253 2760	15 58.09	11 52 13.11 20.84
25	12 04 32.69 ^s 215.79	- 0 29 33.1 -1402.9	1.002 9493 -2765	15 58.35	11 51 52.27 - 20.67
26	12 08 08.48 ^s 215.98	0 52 56.0 1403.1	.002 6728 2772	15 58.62	11 51 31.60 20.48
27	12 11 44.46 ^s 216.18	1 16 19.1 1402.9	.002 3956 2779	15 58.88	11 51 11.12 20.27
28	12 15 20.64 ^s 216.41	1 39 42.0 1402.4	.002 1177 2791	15 59.15	11 50 50.85 20.03
29	12 18 57.05 ^s 216.65	2 03 04.4 1401.4	.001 8386 2801	15 59.42	11 50 30.82 19.77
30	12 22 33.70 ^s 216.91	- 2 26 25.8 -1400.2	1.001 5585 -2816	15 59.68	11 50 11.05 - 19.50
Oct. 1	12 26 10.61 ^s	- 2 49 46.0	1.001 2769	15 59.95	11 49 51.55

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967-0	Redn. to App. Long.	Latitude Ecliptic of			Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic	
			1967-0	1950-0	Date				23° 26'	
Oct.	1 187 07 29.4	+ 8.7	+0.82	+2.55	+0.74	8.79	+37.570	- 8.455	45.105	
	2 188 06 30.5 3541.1	8.7	0.74	2.60	.65	8.79	37.707	8.540	45.149	
	3 189 05 33.7 3543.2	8.7	0.63	2.63	.54	8.79	37.845	8.664	45.173	
	4 190 04 39.1 3545.4	8.7	0.50	2.63	.40	8.80	37.983	8.798	45.165	
	5 191 03 46.5 3547.4	8.7	0.37	2.63	.26	8.80	38.120	8.908	45.128	
	6 192 02 55.8 3549.3	+ 8.8	+0.23	+2.63	+0.12	8.80	+38.258	- 8.963	45.071	
	7 193 02 07.1 3551.3	9.0	+0.10	2.63	-.01	8.80	38.396	8.954	45.008	
	8 194 01 20.1 3553.0	9.2	-0.01	2.65	.13	8.81	38.533	8.888	44.956	
	9 195 00 34.9 3554.8	9.4	0.10	2.69	.23	8.81	38.671	8.790	44.924	
	10 195 59 51.5 3556.6	9.6	0.17	2.75	.30	8.81	38.808	8.690	44.919	
	11 196 59 09.8 3558.3	+ 9.8	-0.20	+2.85	-0.34	8.81	+38.946	- 8.614	44.935	
	12 197 58 29.8 3560.0	10.0	0.20	2.97	.34	8.82	39.084	8.578	44.966	
	13 198 57 51.6 3561.8	10.1	0.17	3.13	.32	8.82	39.221	8.590	45.002	
	14 199 57 15.2 3563.6	10.2	0.10	3.32	.26	8.82	39.359	8.647	45.036	
	15 200 56 40.7 3565.5	10.2	-0.02	3.53	.18	8.82	39.497	8.740	45.059	
	16 201 56 08.0 3567.3	+10.2	+0.09	+3.76	-0.08	8.83	+39.634	- 8.858	45.066	
	17 202 55 37.2 3569.2	10.2	0.21	4.01	+ .03	8.83	39.772	8.983	45.057	
	18 203 55 08.4 3571.2	10.3	0.34	4.26	.16	8.83	39.910	9.098	45.030	
	19 204 54 41.6 3573.2	10.3	0.48	4.51	.29	8.83	40.047	9.191	44.986	
	20 205 54 16.8 3575.2	10.4	0.61	4.76	.41	8.84	40.185	9.252	44.935	
	21 206 53 54.2 3577.4	+10.5	+0.73	+5.01	+0.53	8.84	+40.323	- 9.275	44.881	
	22 207 53 33.6 3579.4	10.6	0.84	5.23	.64	8.84	40.460	9.257	44.830	
	23 208 53 15.2 3581.6	10.8	0.94	5.44	.72	8.84	40.598	9.209	44.789	
	24 209 52 59.0 3583.8	11.0	1.01	5.63	.79	8.85	40.735	9.137	44.764	
	25 210 52 45.0 3586.0	11.2	1.07	5.78	.82	8.85	40.873	9.056	44.757	
	26 211 52 33.2 3588.2	+11.4	+1.07	+5.91	+0.83	8.85	+41.011	- 8.985	44.768	
	27 212 52 23.7 3590.5	11.6	1.05	6.00	.81	8.85	41.148	8.938	44.795	
	28 213 52 16.5 3592.8	11.8	1.00	6.06	.76	8.86	41.286	8.933	44.830	
	29 214 52 11.4 3594.9	11.8	0.92	6.09	.67	8.86	41.424	8.975	44.864	
	30 215 52 08.6 3597.2	11.9	0.82	6.10	.56	8.86	41.561	9.057	44.881	
	31 216 52 07.8 3599.2	+11.9	+0.70	+6.08	+0.43	8.86	+41.699	- 9.163	44.876	
Nov.	1 217 52 09.2 3601.4	12.0	0.56	6.05	.29	8.87	41.837	9.258	44.840	
	2 218 52 12.5 3603.3	12.0	0.42	6.01	.15	8.87	41.974	9.309	44.779	
	3 219 52 17.8 3605.3	12.2	0.29	5.97	+ .01	8.87	42.112	9.293	44.703	
	4 220 52 24.8 3607.0	12.4	0.17	5.95	- .12	8.87	42.249	9.211	44.633	
	5 221 52 33.6 3608.8	+12.7	+0.06	+5.94	-0.23	8.87	+42.387	- 9.080	44.580	
	6 222 52 43.9 3610.3	12.9	-0.01	5.96	.31	8.88	42.525	8.931	44.555	
	7 223 52 55.8 3611.9	13.2	0.06	6.00	.36	8.88	42.662	8.797	44.555	
	8 224 53 09.2 3613.4	13.4	0.08	6.08	.39	8.88	42.800	8.705	44.576	
	9 225 53 24.1 3614.9	13.6	0.06	6.18	.37	8.88	42.938	8.661	44.606	
	10 226 53 40.5 3616.4	+13.7	-0.01	+6.32	-0.33	8.89	+43.075	- 8.667	44.633	
	11 227 53 58.3 3617.8	13.8	+0.06	6.48	.26	8.89	43.213	8.714	44.654	
	12 228 54 17.5 3619.2	13.9	0.16	6.65	.17	8.89	43.351	8.788	44.659	
	13 229 54 38.2 3620.7	13.9	0.27	6.85	- .07	8.89	43.488	8.873	44.647	
	14 230 55 00.5 3622.3	14.0	0.39	7.05	+ .05	8.89	43.626	8.952	44.619	
	15 231 55 24.2 3623.7	+14.1	+0.52	+7.25	+0.18	8.90	+43.763	- 9.013	44.576	
	16 232 55 49.4 3625.2	+14.2	+0.65	+7.46	+0.30	8.90	+43.901	- 9.040	44.522	

To obtain the longitude referred to the mean equinox of 1950-0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ^{''}		['] ^{''}	^h ^m ^s
Oct. 1	12 26 10.61 ^s 217.18	- 2 49 46.0 ^s -1398.6	1.001 2769 -2832	15 59.95	11 49 51.55 ^s - 19.22
2	12 29 47.79 ^s 217.49	3 13 04.6 ^s 1396.5	.000 9937 2849	16 00.23	11 49 32.33 ^s 18.90
3	12 33 25.28 ^s 217.79	3 36 21.1 ^s 1394.1	.000 7088 2868	16 00.50	11 49 13.43 ^s 18.59
4	12 37 03.07 ^s 218.13	3 59 35.2 ^s 1391.3	.000 4220 2886	16 00.77	11 48 54.84 ^s 18.25
5	12 40 41.20 ^s 218.48	4 22 46.5 ^s 1388.2	1.000 1334 2903	16 01.05	11 48 36.59 ^s 17.90
6	12 44 19.68 ^s 218.84	- 4 45 54.7 ^s -1384.5	0.999 8431 -2917	16 01.33	11 48 18.69 ^s - 17.52
7	12 47 58.52 ^s 219.22	5 08 59.2 ^s 1380.6	.999 5514 2928	16 01.61	11 48 01.17 ^s 17.14
8	12 51 37.74 ^s 219.63	5 31 59.8 ^s 1376.3	.999 2586 2935	16 01.89	11 47 44.03 ^s 16.74
9	12 55 17.37 ^s 220.02	5 54 56.1 ^s 1371.5	.998 9651 2937	16 02.18	11 47 27.29 ^s 16.32
10	12 58 57.39 ^s 220.46	6 17 47.6 ^s 1366.3	.998 6714 2935	16 02.46	11 47 10.97 ^s 15.88
11	13 02 37.85 ^s 220.91	- 6 40 33.9 ^s -1360.9	0.998 3779 -2930	16 02.74	11 46 55.09 ^s - 15.42
12	13 06 18.76 ^s 221.38	7 03 14.8 ^s 1355.0	.998 0849 2920	16 03.02	11 46 39.67 ^s 14.94
13	13 10 00.14 ^s 221.86	7 25 49.8 ^s 1348.7	.997 7929 2909	16 03.31	11 46 24.73 ^s 14.43
14	13 13 42.00 ^s 222.38	7 48 18.5 ^s 1342.2	.997 5020 2892	16 03.59	11 46 10.30 ^s 13.92
15	13 17 24.38 ^s 222.90	8 10 40.7 ^s 1335.2	.997 2128 2875	16 03.87	11 45 56.38 ^s 13.37
16	13 21 07.28 ^s 223.46	- 8 32 55.9 ^s -1328.0	0.996 9253 -2856	16 04.14	11 45 43.01 ^s - 12.81
17	13 24 50.74 ^s 224.04	8 55 03.9 ^s 1320.3	.996 6397 2835	16 04.42	11 45 30.20 ^s 12.22
18	13 28 34.78 ^s 224.62	9 17 04.2 ^s 1312.2	.996 3562 2813	16 04.70	11 45 17.98 ^s 11.62
19	13 32 19.40 ^s 225.25	9 38 56.4 ^s 1304.0	.996 0749 2789	16 04.97	11 45 06.36 ^s 11.00
20	13 36 04.65 ^s 225.88	10 00 40.4 ^s 1295.1	.995 7960 2766	16 05.24	11 44 55.36 ^s 10.36
21	13 39 50.53 ^s 226.53	-10 22 15.5 ^s -1286.2	0.995 5194 -2743	16 05.51	11 44 45.00 ^s - 9.69
22	13 43 37.06 ^s 227.21	10 43 41.7 ^s 1276.6	.995 2451 2720	16 05.77	11 44 35.31 ^s 9.02
23	13 47 24.27 ^s 227.90	11 04 58.3 ^s 1266.8	.994 9731 2697	16 06.04	11 44 26.29 ^s 8.32
24	13 51 12.17 ^s 228.60	11 26 05.1 ^s 1256.5	.994 7034 2676	16 06.30	11 44 17.97 ^s 7.60
25	13 55 00.77 ^s 229.32	11 47 01.6 ^s 1246.0	.994 4358 2657	16 06.56	11 44 10.37 ^s 6.88
26	13 58 50.09 ^s 230.06	-12 07 47.6 ^s -1234.9	0.994 1701 -2638	16 06.82	11 44 03.49 ^s - 6.14
27	14 02 40.15 ^s 230.80	12 28 22.5 ^s 1223.5	.993 9063 2621	16 07.07	11 43 57.35 ^s 5.38
28	14 06 30.95 ^s 231.57	12 48 46.0 ^s 1211.7	.993 6442 2608	16 07.33	11 43 51.97 ^s 4.61
29	14 10 22.52 ^s 232.34	13 08 57.7 ^s 1199.3	.993 3834 2597	16 07.58	11 43 47.36 ^s 3.83
30	14 14 14.86 ^s 233.11	13 28 57.0 ^s 1186.7	.993 1237 2587	16 07.84	11 43 43.53 ^s 3.04
31	14 18 07.97 ^s 233.92	-13 48 43.7 ^s -1173.6	0.992 8650 -2580	16 08.09	11 43 40.49 ^s - 2.25
Nov. 1	14 22 01.89 ^s 234.71	14 08 17.3 ^s 1160.1	.992 6070 2574	16 08.34	11 43 38.24 ^s 1.45
2	14 25 56.60 ^s 235.51	14 27 37.4 ^s 1146.1	.992 3496 2567	16 08.59	11 43 36.79 ^s - 0.64
3	14 29 52.11 ^s 236.33	14 46 43.5 ^s 1131.7	.992 0929 2560	16 08.84	11 43 36.15 ^s + 0.16
4	14 33 48.44 ^s 237.14	15 05 35.2 ^s 1116.8	.991 8369 2549	16 09.09	11 43 36.31 ^s + 0.97
5	14 37 45.58 ^s 237.95	-15 24 12.0 ^s -1101.6	0.991 5820 -2538	16 09.34	11 43 37.28 ^s + 1.78
6	14 41 43.53 ^s 238.76	15 42 33.6 ^s 1085.9	.991 3282 2522	16 09.59	11 43 39.06 ^s 2.60
7	14 45 42.29 ^s 239.58	16 00 39.5 ^s 1069.8	.991 0760 2501	16 09.83	11 43 41.66 ^s 3.41
8	14 49 41.87 ^s 240.40	16 18 29.3 ^s 1053.2	.990 8259 2477	16 10.08	11 43 45.07 ^s 4.24
9	14 53 42.27 ^s 241.21	16 36 02.5 ^s 1036.3	.990 5782 2450	16 10.32	11 43 49.31 ^s 5.07
10	14 57 43.48 ^s 242.05	-16 53 18.8 ^s -1018.9	0.990 3332 -2418	16 10.56	11 43 54.38 ^s + 5.90
11	15 01 45.53 ^s 242.87	17 10 17.7 ^s 1001.3	.990 0914 2383	16 10.80	11 44 00.28 ^s 6.73
12	15 05 48.40 ^s 243.70	17 26 59.0 ^s 983.1	.989 8531 2347	16 11.03	11 44 07.01 ^s 7.57
13	15 09 52.10 ^s 244.55	17 43 22.1 ^s 964.7	.989 6184 2308	16 11.26	11 44 14.58 ^s 8.40
14	15 13 56.65 ^s 245.38	17 59 26.8 ^s 945.8	.989 3876 2265	16 11.49	11 44 22.98 ^s 9.24
15	15 18 02.03 ^s 246.23	-18 15 12.6 ^s - 926.6	0.989 1611 -2222	16 11.71	11 44 32.22 ^s + 10.09
16	15 22 08.26 ^s	-18 30 39.2 ^s	0.988 9389	16 11.93	11 44 42.31 ^s

SUN, 1967
FOR 0^h EPHEMERIS TIME

Date	Longitude Mean Equinox of 1967.0	Redn. to App. Long.	Latitude Ecliptic of		Date	Hor. Par.	Prec. in Long.	Nutation in Long.	Obl. of Ecliptic 23° 26'
			1967.0	1950.0					
Nov. 16	232 55 49.4 3626.8	+14.2	+0.65	+7.46	+0.30	8.90	+43.901	- 9.040	44.522
17	233 56 16.2 3628.3	14.3	0.77	7.65	.42	8.90	44.039	9.032	44.463
18	234 56 44.5 3630.0	14.5	0.88	7.83	.52	8.90	44.176	8.982	44.409
19	235 57 14.5 3631.5	14.7	0.98	8.00	.61	8.90	44.314	8.898	44.362
20	236 57 46.0 3633.2	14.9	1.05	8.14	.68	8.91	44.452	8.789	44.331
21	237 58 19.2 3634.9	+15.2	+1.10	+8.25	+0.73	8.91	+44.589	- 8.670	44.318
22	238 58 54.1 3636.6	15.5	1.12	8.33	.74	8.91	44.727	8.556	44.324
23	239 59 30.7 3638.2	15.7	1.11	8.38	.72	8.91	44.865	8.465	44.347
24	241 00 08.9 3640.0	15.9	1.06	8.39	.68	8.91	45.002	8.409	44.379
25	242 00 48.9 3641.6	16.0	0.99	8.37	.60	8.91	45.140	8.399	44.413
26	243 01 30.5 3643.3	+16.1	+0.89	+8.33	+0.50	8.92	+45.278	- 8.430	44.438
27	244 02 13.8 3644.9	16.2	0.77	8.26	.37	8.92	45.415	8.488	44.443
28	245 02 58.7 3646.4	16.3	0.63	8.17	.23	8.92	45.553	8.549	44.421
29	246 03 45.1 3647.9	16.4	0.49	8.08	+ .09	8.92	45.690	8.583	44.375
30	247 04 33.0 3649.2	16.5	0.35	7.98	- .06	8.92	45.828	8.559	44.310
Dec. 1	248 05 22.2 3650.5	+16.7	+0.23	+7.89	-0.19	8.92	+45.966	- 8.467	44.241
2	249 06 12.7 3651.7	17.0	0.11	7.82	.30	8.93	46.103	8.312	44.185
3	250 07 04.4 3652.7	17.4	+0.03	7.77	.39	8.93	46.241	8.123	44.153
4	251 07 57.1 3653.6	17.7	-0.03	7.75	.45	8.93	46.379	7.933	44.151
5	252 08 50.7 3654.5	18.0	0.06	7.75	.48	8.93	46.516	7.776	44.172
6	253 09 45.2 3655.2	+18.2	-0.05	+7.79	-0.48	8.93	+46.654	- 7.669	44.209
7	254 10 40.4 3656.0	18.4	-0.01	7.85	.45	8.93	46.792	7.617	44.249
8	255 11 36.4 3656.7	18.5	+0.05	7.94	.39	8.93	46.929	7.613	44.283
9	256 12 33.1 3657.4	18.6	0.13	8.05	.30	8.93	47.067	7.644	44.303
10	257 13 30.5 3658.0	18.7	0.24	8.17	.20	8.94	47.204	7.692	44.308
11	258 14 28.5 3658.6	+18.8	+0.35	+8.30	-0.09	8.94	+47.342	- 7.740	44.294
12	259 15 27.1 3659.3	18.9	0.47	8.44	+ .03	8.94	47.480	7.773	44.265
13	260 16 26.4 3659.9	19.0	0.59	8.57	.15	8.94	47.617	7.779	44.226
14	261 17 26.3 3660.6	19.2	0.71	8.70	.26	8.94	47.755	7.748	44.181
15	262 18 26.9 3661.1	19.4	0.81	8.81	.36	8.94	47.893	7.678	44.136
16	263 19 28.0 3661.8	+19.7	+0.90	+8.90	+0.45	8.94	+48.030	- 7.573	44.100
17	264 20 29.8 3662.5	19.9	0.97	8.97	.52	8.94	48.168	7.440	44.079
18	265 21 32.3 3663.2	20.2	1.02	9.01	.56	8.94	48.306	7.292	44.075
19	266 22 35.5 3663.8	20.5	1.04	9.03	.58	8.94	48.443	7.147	44.091
20	267 23 39.3 3664.6	20.7	1.02	9.01	.57	8.94	48.581	7.025	44.125
21	268 24 43.9 3665.3	+21.0	+0.98	+8.97	+0.53	8.95	+48.718	- 6.940	44.172
22	269 25 49.2 3666.1	21.1	0.92	8.89	.46	8.95	48.856	6.898	44.220
23	270 26 55.3 3666.8	21.3	0.82	8.78	.37	8.95	48.994	6.900	44.263
24	271 28 02.1 3667.5	21.4	0.71	8.65	.25	8.95	49.131	6.934	44.289
25	272 29 09.6 3668.2	21.5	0.57	8.50	+ .12	8.95	49.269	6.980	44.292
26	273 30 17.8 3668.8	+21.6	+0.43	+8.34	-0.02	8.95	+49.407	- 7.010	44.271
27	274 31 26.6 3669.4	21.7	0.29	8.17	.16	8.95	49.544	6.996	44.229
28	275 32 36.0 3669.9	21.9	0.16	8.02	.30	8.95	49.682	6.923	44.180
29	276 33 45.9 3670.2	22.2	+0.05	7.88	.41	8.95	49.820	6.785	44.134
30	277 34 56.1 3670.5	22.5	-0.04	7.75	.50	8.95	49.957	6.601	44.111
31	278 36 06.6 3670.7	+22.9	-0.11	+7.65	-0.57	8.95	+50.095	- 6.401	44.114
32	279 37 17.3	+23.2	-0.16	+7.57	-0.61	8.95	+50.232	- 6.218	44.144

To obtain the longitude referred to the mean equinox of 1950.0, subtract 14' 14".6.

SUN, 1967
FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Radius Vector	Semi- diameter	Ephemeris Transit
	^h ^m ^s	[°] ['] ["]		['] ["]	^h ^m ^s
Nov. 16	15 22 08.26 ^s	-18 30 39.2	0.988 9389	16 11.93	11 44 42.31 ^s
17	15 26 15.33 ^s	18 45 46.2	.988 7212	16 12.14	11 44 53.23 ^s
18	15 30 23.23 ^s	19 00 33.3	.988 5081	16 12.35	11 45 04.99 ^s
19	15 34 31.98 ^s	19 15 00.1	.988 2996	16 12.56	11 45 17.59 ^s
20	15 38 41.57 ^s	19 29 06.3	.988 0958	16 12.76	11 45 31.02 ^s
21	15 42 51.98 ^s	-19 42 51.4	0.987 8966	16 12.96	11 45 45.28 ^s
22	15 47 03.21 ^s	19 56 15.1	.987 7019	16 13.15	11 46 00.35 ^s
23	15 51 15.26 ^s	20 09 17.1	.987 5118	16 13.34	11 46 16.24 ^s
24	15 55 28.12 ^s	20 21 57.0	.987 3260	16 13.52	11 46 32.94 ^s
25	15 59 41.78 ^s	20 34 14.5	.987 1443	16 13.70	11 46 50.43 ^s
26	16 03 56.22 ^s	-20 46 09.1	0.986 9665	16 13.87	11 47 08.70 ^s
27	16 08 11.43 ^s	20 57 40.6	.986 7922	16 14.04	11 47 27.74 ^s
28	16 12 27.40 ^s	21 08 48.5	.986 6213	16 14.21	11 47 47.53 ^s
29	16 16 44.11 ^s	21 19 32.6	.986 4534	16 14.38	11 48 08.05 ^s
30	16 21 01.55 ^s	21 29 52.5	.986 2885	16 14.54	11 48 29.28 ^s
Dec. 1	16 25 19.68 ^s	-21 39 47.9	0.986 1262	16 14.70	11 48 51.19 ^s
2	16 29 38.49 ^s	21 49 18.6	.985 9666	16 14.86	11 49 13.76 ^s
3	16 33 57.94 ^s	21 58 24.1	.985 8097	16 15.02	11 49 36.96 ^s
4	16 38 18.01 ^s	22 07 04.2	.985 6556	16 15.17	11 50 00.76 ^s
5	16 42 38.66 ^s	22 15 18.7	.985 5045	16 15.32	11 50 25.14 ^s
6	16 46 59.87 ^s	-22 23 07.2	0.985 3568	16 15.46	11 50 50.06 ^s
7	16 51 21.61 ^s	22 30 29.5	.985 2127	16 15.61	11 51 15.49 ^s
8	16 55 43.85 ^s	22 37 25.4	.985 0728	16 15.75	11 51 41.42 ^s
9	17 00 06.56 ^s	22 43 54.7	.984 9372	16 15.88	11 52 07.82 ^s
10	17 04 29.72 ^s	22 49 57.1	.984 8063	16 16.01	11 52 34.65 ^s
11	17 08 53.31 ^s	-22 55 32.4	0.984 6803	16 16.13	11 53 01.89 ^s
12	17 13 17.29 ^s	23 00 40.7	.984 5595	16 16.25	11 53 29.50 ^s
13	17 17 41.63 ^s	23 05 21.5	.984 4440	16 16.37	11 53 57.48 ^s
14	17 22 06.32 ^s	23 09 34.8	.984 3342	16 16.48	11 54 25.77 ^s
15	17 26 31.32 ^s	23 13 20.5	.984 2302	16 16.58	11 54 54.36 ^s
16	17 30 56.60 ^s	-23 16 38.6	0.984 1321	16 16.68	11 55 23.22 ^s
17	17 35 22.13 ^s	23 19 28.8	.984 0401	16 16.77	11 55 52.31 ^s
18	17 39 47.89 ^s	23 21 51.0	.983 9542	16 16.85	11 56 21.61 ^s
19	17 44 13.83 ^s	23 23 45.3	.983 8744	16 16.93	11 56 51.09 ^s
20	17 48 39.94 ^s	23 25 11.5	.983 8008	16 17.01	11 57 20.71 ^s
21	17 53 06.18 ^s	-23 26 09.5	0.983 7333	16 17.07	11 57 50.46 ^s
22	17 57 32.52 ^s	23 26 39.4	.983 6716	16 17.14	11 58 20.29 ^s
23	18 01 58.92 ^s	23 26 41.1	.983 6157	16 17.19	11 58 50.17 ^s
24	18 06 25.37 ^s	23 26 14.5	.983 5652	16 17.24	11 59 20.08 ^s
25	18 10 51.82 ^s	23 25 19.6	.983 5199	16 17.29	11 59 49.98 ^s
26	18 15 18.24 ^s	-23 23 56.4	0.983 4794	16 17.33	12 00 19.83 ^s
27	18 19 44.60 ^s	23 22 05.0	.983 4434	16 17.36	12 00 49.60 ^s
28	18 24 10.87 ^s	23 19 45.4	.983 4117	16 17.39	12 01 19.26 ^s
29	18 28 37.00 ^s	23 16 57.6	.983 3841	16 17.42	12 01 48.76 ^s
30	18 33 02.97 ^s	23 13 41.8	.983 3601	16 17.44	12 02 18.06 ^s
31	18 37 28.72 ^s	-23 09 58.0	0.983 3397	16 17.46	12 02 47.14 ^s
32	18 41 54.22 ^s	23 05 46.4	0.983 3229	16 17.48	12 03 15.94 ^s

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X			Y			Z		
Jan.	0	+0.151 4286	- 460	-0.891 3720	+ 2 6209	+2766	-0.386 5345	+1 1364	+1198
	1	.168 6801	17 2515 507	.888 7511	2 8969 2760	.385 3981	1 2559 1195		
	2	.185 8809	17 2008 562	.885 8542	3 1724 2755	.384 1422	1 3752 1193		
	3	.203 0255	17 1446 614	.882 6818	3 4470 2746	.382 7670	1 4942 1190		
	4	.220 1087	17 0832 668	.879 2348	3 7214 2744	.381 2728	1 6131 1189		
	5	+0.237 1251	- 723	-0.875 5134	+ 3 9947	+2733	-0.379 6597	+1 7316	+1185
	6	.254 0692	+16 9441 781	.871 5187	4 2672 2725	.377 9281	1 8497 1181		
	7	.270 9352	16 8660 832	.867 2515	4 5382 2710	.376 0784	1 9674 1177		
	8	.287 7180	16 7828 890	.862 7133	4 8082 2700	.374 1110	2 0844 1170		
	9	.304 4118	16 6938 948	.857 9051	5 0767 2685	.372 0266	2 2010 1166		
	10	+0.321 0108	- 999	-0.852 8284	+ 5 3433	+2666	-0.369 8256	+2 3168	+1158
	11	.337 5099	+16 4991 1059	.847 4851	5 6083 2650	.367 5088	2 4318 1150		
	12	.353 9031	16 3932 1109	.841 8768	5 8713 2630	.365 0770	2 5460 1142		
	13	.370 1854	16 2823 1162	.836 0055	6 1321 2608	.362 5310	2 6593 1133		
	14	.386 3515	16 1661 1216	.829 8734	6 3908 2587	.359 8717	2 7716 1123		
	15	+0.402 3960	-1265	-0.823 4826	+ 6 6472	+2564	-0.357 1001	+2 8828	+1112
	16	.418 3140	+15 9180 1314	.816 8354	6 9012 2540	.354 2173	2 9932 1104		
	17	.434 1006	15 7866 1364	.809 9342	7 1526 2514	.351 2241	3 1023 1091		
	18	.449 7508	15 6502 1412	.802 7816	7 4018 2492	.348 1218	3 2103 1080		
	19	.465 2598	15 5090 1459	.795 3798	7 6481 2463	.344 9115	3 3172 1069		
	20	+0.480 6229	-1502	-0.787 7317	+ 7 8919	+2438	-0.341 5943	+3 4229	+1057
	21	.495 8358	+15 2129 1551	.779 8398	8 1328 2409	.338 1714	3 5274 1045		
	22	.510 8936	15 0578 1591	.771 7070	8 3711 2383	.334 6440	3 6306 1032		
	23	.525 7923	14 8987 1636	.763 3359	8 6065 2354	.331 0134	3 7326 1020		
	24	.540 5274	14 7351 1674	.754 7294	8 8393 2328	.327 2808	3 8334 1008		
	25	+0.555 0951	-1718	-0.745 8901	+ 9 0690	+2297	-0.323 4474	+3 9329	+ 995
	26	.569 4910	+14 3959 1754	.736 8211	9 2961 2271	.319 5145	4 0313 984		
	27	.583 7115	14 2205 1798	.727 5250	9 5206 2245	.315 4832	4 1284 971		
	28	.597 7522	14 0407 1836	.718 0044	9 7423 2217	.311 3548	4 2244 960		
	29	.611 6093	13 8571 1876	.708 2621	9 9613 2190	.307 1304	4 3192 948		
	30	+0.625 2788	-1918	-0.698 3008	+10 1776	+2163	-0.302 8112	+4 4128	+ 936
	31	.638 7565	+13 4777 1960	.688 1232	10 3909 2133	.298 3984	4 5053 925		
	1	.652 0382	13 2817 2001	.677 7323	10 6014 2105	.293 8931	4 5965 912		
	2	.665 1198	13 0816 2043	.667 1309	10 8087 2073	.289 2966	4 6866 901		
	3	.677 9971	12 8773 2087	.656 3222	11 0128 2041	.284 6100	4 7750 884		
	4	+0.690 6657	-2127	-0.645 3094	+11 2137	+2009	-0.279 8350	+4 8621	+ 871
	5	.703 1216	+12 4559 2170	.634 0957	11 4108 1971	.274 9729	4 9477 856		
	6	.715 3605	12 2389 2208	.622 6849	11 6044 1936	.270 0252	5 0318 841		
	7	.727 3786	12 0181 2249	.611 0805	11 7941 1897	.264 9934	5 1143 825		
	8	.739 1718	11 7932 2287	.599 2864	11 9802 1861	.259 8791	5 1951 808		
	9	+0.750 7363	-2324	-0.587 3062	+12 1621	+1819	-0.254 6840	+5 2741	+ 790
	10	.762 0684	+11 3321 2360	.575 1441	12 3397 1776	.249 4099	5 3513 772		
	11	.773 1645	11 0961 2393	.562 8044	12 5136 1739	.244 0586	5 4267 754		
	12	.784 0213	10 8568 2427	.550 2908	12 6829 1693	.238 6319	5 5004 737		
	13	.794 6354	10 6141 2457	.537 6079	12 8481 1652	.233 1315	5 5721 717		
	14	+0.805 0038	-2488	-0.524 7598	+13 0091	+1610	-0.227 5594	+5 6418	+ 697
	15	+0.815 1234	+10 1196 -2517	-0.511 7507	+13 0091 +1565	-0.221 9176	+5 6418 + 681		

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X			Y			Z		
Feb. 15	+0.815 1234	+ 9 8679	-2517	-0.511 7507	+13 1656	+1565	-0.221 9176	+5 7099	+ 681
16	.824 9913	9 6135	2544	.498 5851	13 3177	1521	.216 2077	5 7758	659
17	.834 6048	9 3566	2569	.485 2674	13 4655	1478	.210 4319	5 8398	640
18	.843 9614	9 0972	2594	.471 8019	13 6089	1434	.204 5921	5 9020	622
19	.853 0586	8 8354	2618	.458 1930	13 7480	1391	.198 6901	5 9620	600
20	+0.861 8940	+ 8 5713	-2641	-0.444 4450	+13 8824	+1344	-0.192 7281	+6 0205	+ 585
21	.870 4653	8 3056	2657	.430 5626	14 0127	1303	.186 7076	6 0767	562
22	.878 7709	8 0375	2681	.416 5499	14 1386	1259	.180 6309	6 1312	545
23	.886 8084	7 7679	2696	.402 4113	14 2604	1218	.174 4997	6 1838	526
24	.894 5763	7 4961	2718	.388 1509	14 3781	1177	.168 3159	6 2346	508
25	+0.902 0724	+ 7 2226	-2735	-0.373 7728	+14 4915	+1134	-0.162 0813	+6 2838	+ 492
26	.909 2950	6 9472	2754	.359 2813	14 6011	1096	.155 7975	6 3310	472
27	.916 2422	6 6698	2774	.344 6802	14 7063	1052	.149 4665	6 3767	457
28	.922 9120	6 3904	2794	.329 9739	14 8075	1012	.143 0898	6 4204	437
Mar. 1	.929 3024	6 1092	2812	.315 1664	14 9044	969	.136 6694	6 4625	421
2	+0.935 4116	+ 5 8258	-2834	-0.300 2620	+14 9970	+ 926	-0.130 2069	+6 5027	+ 402
3	.941 2374	5 5405	2853	.285 2650	15 0851	881	.123 7042	6 5409	382
4	.946 7779	5 2534	2871	.270 1799	15 1685	834	.117 1633	6 5773	364
5	.952 0313	4 9645	2889	.255 0114	15 2473	788	.110 5860	6 6114	341
6	.956 9958	4 6741	2904	.239 7641	15 3215	742	.103 9746	6 6439	325
7	+0.961 6699	+ 4 3821	-2920	-0.224 4426	+15 3905	+ 690	-0.097 3307	+6 6738	+ 299
8	.966 0520	4 0887	2934	.209 0521	15 4548	643	.090 6569	6 7020	282
9	.970 1407	3 7941	2946	.193 5973	15 5140	592	.083 9549	6 7278	258
10	.973 9348	3 4986	2955	.178 0833	15 5684	544	.077 2271	6 7515	237
11	.977 4334	3 2019	2967	.162 5149	15 6176	492	.070 4756	6 7729	214
12	+0.980 6353	+ 2 9047	-2972	-0.146 8973	+15 6620	+ 444	-0.063 7027	+6 7922	+ 193
13	.983 5400	2 6070	2977	.131 2353	15 7013	393	.056 9105	6 8094	172
14	.986 1470	2 3085	2985	.115 5340	15 7355	342	.050 1011	6 8242	148
15	.988 4555	2 0099	2986	.099 7985	15 7648	293	.043 2769	6 8370	128
16	.990 4654	1 7111	2988	.084 0337	15 7890	242	.036 4399	6 8474	104
17	+0.992 1765	+ 1 4122	-2989	-0.068 2447	+15 8084	+ 194	-0.029 5925	+6 8558	+ 84
18	.993 5887	1 1134	2988	.052 4363	15 8229	145	.022 7367	6 8619	61
19	.994 7021	8148	2986	.036 6134	15 8323	94	.015 8748	6 8661	42
20	.995 5169	5168	2980	.020 7811	15 8371	48	.009 0087	6 8679	+ 18
21	.996 0337	+ 2190	2978	-.004 9440	15 8372	+ 1	-.002 1408	6 8677	- 2
22	+0.996 2527	- 779	-2969	+0.010 8932	+15 8326	- 46	+0.004 7269	+6 8656	- 21
23	.996 1748	3745	2966	.026 7258	15 8237	89	.011 5925	6 8616	40
24	.995 8003	6702	2957	.042 5495	15 8101	136	.018 4541	6 8555	61
25	.995 1301	9654	2952	.058 3596	15 7925	176	.025 3096	6 8478	77
26	.994 1647	1 2599	2945	.074 1521	15 7706	219	.032 1574	6 8381	97
27	+0.992 9048	- 1 5541	-2942	+0.089 9227	+15 7443	- 263	+0.038 9955	+6 8266	- 115
28	.991 3507	1 8475	2934	.105 6670	15 7136	307	.045 8221	6 8134	132
29	.989 5032	2 1406	2931	.121 3806	15 6790	346	.052 6355	6 7983	151
30	.987 3626	2 4332	2926	.137 0596	15 6395	395	.059 4338	6 7813	170
31	.984 9294	2 7252	2920	.152 6991	15 5957	438	.066 2151	6 7625	188
Apr. 1	+0.982 2042	- 3 0165	-2913	+0.168 2948	+15 5473	- 484	+0.072 9776	+6 7415	- 210
2	+0.979 1877	-2906	-2906	+0.183 8421	- 531	- 531	+0.079 7191	- 228	- 228

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967-0

Date	X			Y			Z		
Apr.	1	+0.982 2042	- 3 0165 -2913	+0.168 2948	+15 5473 - 484	+0.072 9776	+6 7415 - 210		
	2	.979 1877	3 3071 2906	.183 8421	15 4942 531	.079 7191	6 7187 228		
	3	.975 8806	3 5967 2896	.199 3363	15 4364 578	.086 4378	6 6938 249		
	4	.972 2839	3 8853 2886	.214 7727	15 3740 624	.093 1316	6 6668 270		
	5	.968 3986	4 1728 2875	.230 1467	15 3068 672	.099 7984	6 6378 290		
	6	+0.964 2258	- 4 4589 -2861	+0.245 4535	+15 2347 - 721	+0.106 4362	+6 6069 - 309		
	7	.959 7669	4 7434 2845	.260 6882	15 1583 764	.113 0431	6 5737 332		
	8	.955 0235	5 0266 2832	.275 8465	15 0770 813	.119 6168	6 5385 352		
	9	.949 9969	5 3077 2811	.290 9235	14 9910 860	.126 1553	6 5014 371		
	10	.944 6892	5 5872 2795	.305 9145	14 9006 904	.132 6567	6 4622 392		
	11	+0.939 1020	- 5 8646 -2774	+0.320 8151	+14 8054 - 952	+0.139 1189	+6 4210 - 412		
	12	.933 2374	6 1398 2752	.335 6205	14 7061 993	.145 5399	6 3779 431		
	13	.927 0976	6 4129 2731	.350 3266	14 6020 1041	.151 9178	6 3326 453		
	14	.920 6847	6 6835 2706	.364 9286	14 4937 1083	.158 2504	6 2856 470		
	15	.914 0012	6 9517 2682	.379 4223	14 3810 1127	.164 5360	6 2367 489		
	16	+0.907 0495	- 7 2172 -2655	+0.393 8033	+14 2644 -1166	+0.170 7727	+6 1859 - 508		
	17	.899 8323	7 4801 2629	.408 0677	14 1435 1209	.176 9586	6 1334 525		
	18	.892 3522	7 7400 2599	.422 2112	14 0189 1246	.183 0920	6 0791 543		
	19	.884 6122	7 9973 2573	.436 2301	13 8903 1286	.189 1711	6 0232 559		
	20	.876 6149	8 2517 2544	.450 1204	13 7580 1323	.195 1943	5 9657 575		
	21	+0.868 3632	- 8 5032 -2515	+0.463 8784	+13 6223 -1357	+0.201 1600	+5 9067 - 590		
	22	.859 8600	8 7519 2487	.477 5007	13 4831 1392	.207 0667	5 8462 605		
	23	.851 1081	8 9980 2461	.490 9838	13 3405 1426	.212 9129	5 7843 619		
	24	.842 1101	9 2413 2433	.504 3243	13 1945 1460	.218 6972	5 7210 633		
	25	.832 8688	9 4819 2406	.517 5188	13 0452 1493	.224 4182	5 6561 649		
	26	+0.823 3869	- 9 7203 -2384	+0.530 5640	+12 8925 -1527	+0.230 0743	+5 5900 - 661		
	27	.813 6666	9 9557 2354	.543 4565	12 7362 1563	.235 6643	5 5224 676		
	28	.803 7109	10 1886 2329	.556 1927	12 5765 1597	.241 1867	5 4532 692		
	29	.793 5223	10 4189 2303	.568 7692	12 4131 1634	.246 6399	5 3826 706		
	30	.783 1034	10 6463 2274	.581 1823	12 2462 1669	.252 0225	5 3103 723		
May	1	+0.772 4571	-10 8708 -2245	+0.593 4285	+12 0756 -1706	+0.257 3328	+5 2365 - 738		
	2	.761 5863	11 0920 2212	.605 5041	11 9015 1741	.262 5693	5 1612 753		
	3	.750 4943	11 3102 2182	.617 4056	11 7237 1778	.267 7305	5 0841 771		
	4	.739 1841	11 5249 2147	.629 1293	11 5425 1812	.272 8146	5 0058 783		
	5	.727 6592	11 7363 2114	.640 6718	11 3579 1846	.277 8204	4 9258 800		
	6	+0.715 9229	-11 9442 -2079	+0.652 0297	+11 1696 -1883	+0.282 7462	+4 8443 - 815		
	7	.703 9787	12 1483 2041	.663 1993	10 9784 1912	.287 5905	4 7613 830		
	8	.691 8304	12 3488 2005	.674 1777	10 7835 1949	.292 3518	4 6770 843		
	9	.679 4816	12 5453 1965	.684 9612	10 5857 1978	.297 0288	4 5910 860		
	10	.666 9363	12 7380 1927	.695 5469	10 3846 2011	.301 6198	4 5039 871		
	11	+0.654 1983	-12 9265 -1885	+0.705 9315	+10 1807 -2039	+0.306 1237	+4 4154 - 885		
	12	.641 2718	13 1109 1844	.716 1122	9 9738 2069	.310 5391	4 3255 899		
	13	.628 1609	13 2911 1802	.726 0860	9 7641 2097	.314 8646	4 2345 910		
	14	.614 8698	13 4672 1761	.735 8501	9 5516 2125	.319 0991	4 1422 923		
	15	.601 4026	13 6385 1713	.745 4017	9 3369 2147	.323 2413	4 0488 934		
	16	+0.587 7641	-13 8059 -1674	+0.754 7386	+9 1197 -2172	+0.327 2901	+3 9545 - 943		
	17	+0.573 9582	-1627	+0.763 8583	-2196	+0.331 2446	- 953		

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967-0

Date	X			Y			Z		
May 17	+0.573 9582	-13 9686	-1627	+0.763 8583	+ 8 9001	-2196	+0.331 2446	+3 8592	- 953
18	.559 9896	14 1273	1587	.772 7584	8 6786	2215	.335 1038	3 7629	963
19	.545 8623	14 2814	1541	.781 4370	8 4550	2236	.338 8667	3 6659	970
20	.531 5809	14 4315	1501	.789 8920	8 2297	2253	.342 5326	3 5679	980
21	.517 1494	14 5774	1459	.798 1217	8 0024	2273	.346 1005	3 4695	984
22	+0.502 5720	-14 7192	-1418	+0.806 1241	+ 7 7734	-2290	+0.349 5700	+3 3701	- 994
23	.487 8528	14 8572	1380	.813 8975	7 5425	2309	.352 9401	3 2701	1000
24	.472 9956	14 9912	1340	.821 4400	7 3100	2325	.356 2102	3 1693	1008
25	.458 0044	15 1214	1302	.828 7500	7 0753	2347	.359 3795	3 0676	1017
26	.442 8830	15 2473	1259	.835 8253	6 8391	2362	.362 4471	2 9654	1022
27	+0.427 6357	-15 3697	-1224	+0.842 6644	+ 6 6007	-2384	+0.365 4125	+2 8621	-1033
28	.412 2660	15 4877	1180	.849 2651	6 3605	2402	.368 2746	2 7581	1040
29	.396 7783	15 6016	1139	.855 6256	6 1182	2423	.371 0327	2 6532	1049
30	.381 1767	15 7114	1098	.861 7438	5 8741	2441	.373 6859	2 5476	1056
31	.365 4653	15 8163	1049	.867 6179	5 6283	2458	.376 2335	2 4411	1065
June 1	+0.349 6490	-15 9171	-1008	+0.873 2462	+ 5 3806	-2477	+0.378 6746	+2 3337	-1074
2	.333 7319	16 0133	962	.878 6268	5 1314	2492	.381 0083	2 2258	1079
3	.317 7186	16 1047	914	.883 7582	4 8803	2511	.383 2341	2 1169	1089
4	.301 6139	16 1915	868	.888 6385	4 6279	2524	.385 3510	2 0076	1093
5	.285 4224	16 2737	822	.893 2664	4 3741	2538	.387 3586	1 8974	1102
6	+0.269 1487	-16 3508	- 771	+0.897 6405	+ 4 1188	-2553	+0.389 2560	+1 7867	-1107
7	.252 7979	16 4231	723	.901 7593	3 8624	2564	.391 0427	1 6756	1111
8	.236 3748	16 4904	673	.905 6217	3 6047	2577	.392 7183	1 5636	1120
9	.219 8844	16 5527	623	.909 2264	3 3461	2586	.394 2819	1 4514	1122
10	.203 3317	16 6100	573	.912 5725	3 0866	2595	.395 7333	1 3387	1127
11	+0.186 7217	-16 6621	- 521	+0.915 6591	+ 2 8265	-2601	+0.397 0720	+1 2258	-1129
12	.170 0596	16 7091	470	.918 4856	2 5658	2607	.398 2978	1 1125	1133
13	.153 3505	16 7513	422	.921 0514	2 3045	2613	.399 4103	9990	1135
14	.136 5992	16 7882	369	.923 3559	2 0432	2613	.400 4093	8856	1134
15	.119 8110	16 8204	322	.925 3991	1 7817	2615	.401 2949	7721	1135
16	+0.102 9906	-16 8477	- 273	+0.927 1808	+ 1 5199	-2618	+0.402 0670	+ 6584	-1137
17	.086 1429	16 8703	226	.928 7007	1 2583	2616	.402 7254	5449	1135
18	.069 2726	16 8882	179	.929 9590	9967	2616	.403 2703	4315	1134
19	.052 3844	16 9018	136	.930 9557	7353	2614	.403 7018	3181	1134
20	.035 4826	16 9109	91	.931 6910	4738	2615	.404 0199	2049	1132
21	+0.018 5717	-16 9155	- 46	+0.932 1648	+ 2125	-2613	+0.404 2248	+ 916	-1133
22	+ .001 6562	16 9160	- 5	.932 3773	488	2613	.404 3164	216	1132
23	- .015 2598	16 9120	+ 40	.932 3285	3101	2613	.404 2948	1347	1131
24	.032 1718	16 9036	84	.932 0184	5712	2611	.404 1601	2478	1131
25	.049 0754	16 8908	128	.931 4472	8328	2616	.403 9123	3610	1132
26	-0.065 9662	-16 8735	+ 173	+0.930 6144	+ 1 0941	-2613	+0.403 5513	- 4743	-1133
27	.082 8397	16 8515	220	.929 5203	1 3553	2612	.403 0770	5873	1130
28	.099 6912	16 8249	266	.928 1650	1 6165	2612	.402 4897	7005	1132
29	.116 5161	16 7937	312	.926 5485	1 8774	2609	.401 7892	8136	1131
30	.133 3098	16 7575	362	.924 6711	2 1382	2608	.400 9756	9266	1130
July 1	-0.150 0673	-16 7166	+ 409	+0.922 5329	- 2 3984	-2602	+0.400 0490	-1 0393	-1127
2	-0.166 7839	+ 458		+0.920 1345		-2597	+0.399 0097		-1128

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967-0

Date		X			Y			Z		
July	1	-0.150 0673	-16 7166	+ 409	+0.922 5329	- 2 3984	-2602	+0.400 0490	-1 0393	-1127
	2	·166 7839	16 6708	458	·920 1345	2 6581	2597	·399 0097	1 1521	1128
	3	·183 4547	16 6203	505	·917 4764	2 9176	2595	·397 8576	1 2645	1124
	4	·200 0750	16 5649	554	·914 5588	3 1762	2586	·396 5931	1 3767	1122
	5	·216 6399	16 5043	606	·911 3826	3 4340	2578	·395 2164	1 4887	1120
	6	-0.233 1442	-16 4390	+ 653	+0.907 9486	- 3 6909	-2569	+0.393 7277	-1 6002	-1115
	7	·249 5832	16 3684	706	·904 2577	3 9471	2562	·392 1275	1 7114	1112
	8	·265 9516	16 2932	752	·900 3106	4 2021	2550	·390 4161	1 8220	1106
	9	·282 2448	16 2126	806	·896 1085	4 4555	2534	·388 5941	1 9322	1102
	10	·298 4574	16 1274	852	·891 6530	4 7076	2521	·386 6619	2 0417	1095
	11	-0.314 5848	-16 0373	+ 901	+0.886 9454	- 4 9582	-2506	+0.384 6202	-2 1504	-1087
	12	·330 6221	15 9425	948	·881 9872	5 2069	2487	·382 4698	2 2585	1081
	13	·346 5646	15 8431	994	·876 7803	5 4539	2470	·380 2113	2 3657	1072
	14	·362 4077	15 7394	1037	·871 3264	5 6989	2450	·377 8456	2 4720	1063
	15	·378 1471	15 6312	1082	·865 6275	5 9421	2432	·375 3736	2 5775	1055
	16	-0.393 7783	-15 5188	+1124	+0.859 6854	- 6 1834	-2413	+0.372 7961	-2 6820	-1045
	17	·409 2971	15 4026	1162	·853 5020	6 4226	2392	·370 1141	2 7858	1038
	18	·424 6997	15 2821	1205	·847 0794	6 6600	2374	·367 3283	2 8886	1028
	19	·439 9818	15 1579	1242	·840 4194	6 8955	2355	·364 4397	2 9906	1020
	20	·455 1397	15 0296	1283	·833 5239	7 1291	2336	·361 4491	3 0918	1012
	21	-0.470 1693	-14 8976	+1320	+0.826 3948	- 7 3606	-2315	+0.358 3573	-3 1919	-1001
	22	·485 0669	14 7617	1359	·819 0342	7 5907	2301	·355 1654	3 2916	997
	23	·499 8286	14 6217	1400	·811 4435	7 8186	2279	·351 8738	3 3903	987
	24	·514 4503	14 4779	1438	·803 6249	8 0449	2263	·348 4835	3 4883	980
	25	·528 9282	14 3300	1479	·795 5800	8 2689	2240	·344 9952	3 5852	969
	26	-0.543 2582	-14 1781	+1519	+0.787 3111	- 8 4914	-2225	+0.341 4100	-3 6817	- 965
	27	·557 4363	14 0220	1561	·778 8197	8 7116	2202	·337 7283	3 7771	954
	28	·571 4583	13 8620	1600	·770 1081	8 9295	2179	·333 9512	3 8716	945
	29	·585 3203	13 6978	1642	·761 1786	9 1454	2159	·330 0796	3 9651	935
	30	·599 0181	13 5295	1683	·752 0332	9 3591	2137	·326 1145	4 0579	928
Aug.	31	-0.612 5476	-13 3572	+1723	+0.742 6741	- 9 5701	-2110	+0.322 0566	-4 1495	- 916
	1	·625 9048	13 1807	1765	·733 1040	9 7789	2088	·317 9071	4 2400	905
	2	·639 0855	13 0001	1806	·723 3251	9 9849	2060	·313 6671	4 3295	895
	3	·652 0856	12 8154	1847	·713 3402	10 1884	2035	·309 3376	4 4179	884
	4	·664 9010	12 6267	1887	·703 1518	10 3891	2007	·304 9197	4 5051	872
	5	-0.677 5277	-12 4339	+1928	+0.692 7627	-10 5867	-1976	+0.300 4146	-4 5909	- 858
	6	·689 9616	12 2371	1968	·682 1760	10 7812	1945	·295 8237	4 6754	845
	7	·702 1987	12 0364	2007	·671 3948	10 9725	1913	·291 1483	4 7585	831
	8	·714 2351	11 8321	2043	·660 4223	11 1605	1880	·286 3898	4 8401	816
	9	·726 0672	11 6242	2079	·649 2618	11 3448	1843	·281 5497	4 9203	802
	10	-0.737 6914	-11 4129	+2113	+0.637 9170	-11 5258	-1810	+0.276 6294	-4 9988	- 785
	11	·749 1043	11 1982	2147	·626 3912	11 7033	1775	·271 6306	5 0757	769
	12	·760 3025	10 9807	2175	·614 6879	11 8769	1736	·266 5549	5 1510	753
	13	·771 2832	10 7603	2204	·602 8110	12 0473	1704	·261 4039	5 2249	739
	14	·782 0435	10 5368	2235	·590 7637	12 2139	1666	·256 1790	5 2970	721
	15	-0.792 5803	-10 3109	+2259	+0.578 5498	-12 3773	-1634	+0.250 8820	-5 3677	- 707
	16	-0.802 8912	-10 0829	+2289	+0.566 1725	-12 5399	-1599	+0.245 5143	-5 4406	- 693

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1967-0

Date	X			Y			Z		
Aug. 16	-0.802 8912	-10 0820	+2289	+0.566 1725	-12 5372	-1599	+0.245 5143	-5 4370	- 693
17	.812 9732	9 8507	2313	.553 6353	12 6935	1563	.240 0773	5 5046	676
18	.822 8239	9 6168	2339	.540 9418	12 8467	1532	.234 5727	5 5707	661
19	.832 4407	9 3803	2365	.528 0951	12 9962	1495	.229 0020	5 6356	649
20	.841 8210	9 1410	2393	.515 0989	13 1427	1465	.223 3664	5 6988	632
21	-0.850 9620	- 8 8994	+2416	+0.501 9562	-13 2856	-1429	+0.217 6676	-5 7607	- 619
22	.859 8614	8 6551	2443	.488 6706	13 4252	1396	.211 9069	5 8212	605
23	.868 5165	8 4079	2472	.475 2454	13 5611	1359	.206 0857	5 8801	589
24	.876 9244	8 1583	2496	.461 6843	13 6939	1328	.200 2056	5 9375	574
25	.885 0827	7 9061	2522	.447 9904	13 8226	1287	.194 2681	5 9935	560
26	-0.892 9888	- 7 6512	+2549	+0.434 1678	-13 9481	-1255	+0.188 2746	-6 0478	- 543
27	.900 6400	7 3938	2574	.420 2197	14 0695	1214	.182 2268	6 1005	527
28	.908 0338	7 1339	2599	.406 1502	14 1873	1178	.176 1263	6 1517	512
29	.915 1677	6 8714	2625	.391 9629	14 3012	1139	.169 9746	6 2012	495
30	.922 0391	6 6067	2647	.377 6617	14 4111	1099	.163 7734	6 2489	477
Sept. 31	-0.928 6458	- 6 3392	+2675	+0.363 2506	-14 5171	-1060	+0.157 5245	-6 2951	- 462
1	.934 9850	6 0695	2697	.348 7335	14 6188	1017	.151 2294	6 3394	443
2	.941 0545	5 7975	2720	.334 1147	14 7162	974	.144 8900	6 3817	423
3	.946 8520	5 5232	2743	.319 3985	14 8094	932	.138 5083	6 4223	406
4	.952 3752	5 2469	2763	.304 5891	14 8977	883	.132 0860	6 4608	385
5	-0.957 6221	- 4 9687	+2782	+0.289 6914	-14 9816	- 839	+0.125 6252	-6 4973	- 365
6	.962 5908	4 6889	2798	.274 7098	15 0610	794	.119 1279	6 5317	344
7	.967 2797	4 4075	2814	.259 6488	15 1355	745	.112 5962	6 5641	324
8	.971 6872	4 1248	2827	.244 5133	15 2051	696	.106 0321	6 5943	302
9	.975 8120	3 8411	2837	.229 3082	15 2705	654	.099 4378	6 6225	282
10	-0.979 6531	- 3 5565	+2846	+0.214 0377	-15 3311	- 606	+0.092 8153	-6 6488	- 263
11	.983 2096	3 2709	2856	.198 7066	15 3872	561	.086 1665	6 6730	242
12	.986 4805	2 9845	2864	.183 3194	15 4388	516	.079 4935	6 6953	223
13	.989 4650	2 6976	2869	.167 8806	15 4862	474	.072 7982	6 7155	202
14	.992 1626	2 4100	2876	.152 3944	15 5292	430	.066 0827	6 7341	186
15	-0.994 5726	- 2 1215	+2885	+0.136 8652	-15 5680	- 388	+0.059 3486	-6 7507	- 166
16	0.996 6941	1 8326	2889	.121 2972	15 6024	344	.052 5979	6 7655	148
17	0.998 5267	1 5431	2895	.105 6948	15 6326	302	.045 8324	6 7785	130
18	1.000 0698	1 2529	2902	.090 0622	15 6587	261	.039 0539	6 7897	112
19	1.001 3227	9621	2908	.074 4035	15 6803	216	.032 2642	6 7989	92
20	-1.002 2848	- 6709	+2912	+0.058 7232	-15 6978	- 175	+0.025 4653	-6 8066	- 77
21	1.002 9557	3790	2919	.043 0254	15 7109	131	.018 6587	6 8121	55
22	1.003 3347	867	2923	.027 3145	15 7196	87	.011 8466	6 8161	40
23	1.003 4214	2062	2929	+ .011 5949	15 7240	- 44	+ .005 0305	6 8179	18
24	1.003 2152	4993	2931	- .004 1291	15 7239	+ 1	- .001 7874	6 8180	- 1
25	-1.002 7159	+ 7930	+2937	-0.019 8530	-15 7193	+ 46	-0.008 6054	-6 8161	+ 19
26	1.001 9229	1 0869	2939	.035 5723	15 7103	90	.015 4215	6 8123	38
27	1.000 8360	1 3810	2941	.051 2826	15 6965	138	.022 2338	6 8064	59
28	0.999 4550	1 6755	2945	.066 9791	15 6783	182	.029 0402	6 7988	76
29	0.997 7795	1 9698	2943	.082 6574	15 6552	231	.035 8390	6 7888	100
30	-0.995 8097	+ 2 2643	+2945	-0.098 3126	-15 6273	+ 279	-0.042 6278	-6 7770	+ 118
Oct. 1	-0.993 5454	+2945	+2945	-0.113 9399	+ 328	+ 328	-0.049 4048	+ 142	+ 142

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967-0

Date		X			Y			Z		
Oct.	1	-0.993 5454	+ 2 5588	+2945	-0.113 9399	-15 5945	+ 328	-0.049 4048	-6 7628	+ 142
	2	.990 9866	2 8528	2940	.129 5344	15 5568	377	.056 1676	6 7467	161
	3	.988 1338	3 1464	2936	.145 0912	15 5138	430	.062 9143	6 7281	186
	4	.984 9874	3 4394	2930	.160 6050	15 4662	476	.069 6424	6 7075	206
	5	.981 5480	3 7315	2921	.176 0712	15 4132	530	.076 3499	6 6846	229
	6	-0.977 8165	+ 4 0223	+2908	-0.191 4844	-15 3555	+ 577	-0.083 0345	-6 6594	+ 252
	7	.973 7942	4 3118	2895	.206 8399	15 2927	628	.089 6939	6 6322	272
	8	.969 4824	4 6000	2882	.222 1326	15 2255	672	.096 3261	6 6029	293
	9	.964 8824	4 8864	2864	.237 3581	15 1534	721	.102 9290	6 5714	315
	10	.959 9960	5 1714	2850	.252 5115	15 0768	766	.109 5004	6 5381	333
	11	-0.954 8246	+ 5 4546	+2832	-0.267 5883	-14 9960	+ 808	-0.116 0385	-6 5029	+ 352
	12	.949 3700	5 7363	2817	.282 5843	14 9106	854	.122 5414	6 4658	371
	13	.943 6337	6 0161	2798	.297 4949	14 8211	895	.129 0072	6 4267	391
	14	.937 6176	6 2943	2782	.312 3160	14 7275	936	.135 4339	6 3859	408
	15	.931 3233	6 5707	2764	.327 0435	14 6295	980	.141 8198	6 3435	424
	16	-0.924 7526	+ 6 8455	+2748	-0.341 6730	-14 5274	+1021	-0.148 1633	-6 2989	+ 446
	17	.917 9071	7 1184	2729	.356 2004	14 4211	1063	.154 4622	6 2529	460
	18	.910 7887	7 3895	2711	.370 6215	14 3107	1104	.160 7151	6 2051	478
	19	.903 3992	7 6587	2692	.384 9322	14 1961	1146	.166 9202	6 1553	498
	20	.895 7405	7 9260	2673	.399 1283	14 0775	1186	.173 0755	6 1040	513
	21	-0.887 8145	+ 8 1914	+2654	-0.413 2058	-13 9546	+1229	-0.179 1795	-6 0507	+ 533
	22	.879 6231	8 4551	2637	.427 1604	13 8276	1270	.185 2302	5 9957	550
	23	.871 1680	8 7163	2612	.440 9880	13 6963	1313	.191 2259	5 9390	567
	24	.862 4517	8 9756	2593	.454 6843	13 5611	1352	.197 1649	5 8804	586
	25	.853 4761	9 2329	2573	.468 2454	13 4215	1396	.203 0453	5 8200	604
	26	-0.844 2432	+ 9 4879	+2550	-0.481 6669	-13 2777	+1438	-0.208 8653	-5 7579	+ 621
	27	.834 7553	9 7403	2524	.494 9446	13 1297	1480	.214 6232	5 6939	640
	28	.825 0150	9 9906	2503	.508 0743	12 9772	1525	.220 3171	5 6279	660
	29	.815 0244	10 2383	2477	.521 0515	12 8206	1566	.225 9450	5 5601	678
	30	.804 7861	10 4831	2448	.533 8721	12 6597	1609	.231 5051	5 4903	698
	31	-0.794 3030	+10 7252	+2421	-0.546 5318	-12 4941	+1656	-0.236 9954	-5 4186	+ 717
Nov.	1	.783 5778	10 9639	2387	.559 0259	12 3243	1698	.242 4140	5 3451	735
	2	.772 6139	11 1995	2356	.571 3502	12 1504	1739	.247 7591	5 2696	755
	3	.761 4144	11 4314	2319	.583 5006	11 9723	1781	.253 0287	5 1925	771
	4	.749 9830	11 6597	2283	.595 4729	11 7902	1821	.258 2212	5 1132	793
	5	-0.738 3233	+11 8840	+2243	-0.607 2631	-11 6042	+1860	-0.263 3344	-5 0325	+ 807
	6	.726 4393	12 1046	2206	.618 8673	11 4147	1895	.268 3669	4 9501	824
	7	.714 3347	12 3212	2166	.630 2820	11 2218	1929	.273 3170	4 8663	838
	8	.702 0135	12 5337	2125	.641 5038	11 0252	1966	.278 1833	4 7809	854
	9	.689 4798	12 7426	2089	.652 5290	10 8256	1996	.282 9642	4 6942	867
	10	-0.676 7372	+12 9474	+2048	-0.663 3546	-10 6228	+2028	-0.287 6584	-4 6061	+ 881
	11	.663 7898	13 1483	2009	.673 9774	10 4169	2059	.292 2645	4 5168	893
	12	.650 6415	13 3453	1970	.684 3943	10 2080	2089	.296 7813	4 4259	909
	13	.637 2962	13 5385	1932	.694 6023	9 9960	2120	.301 2072	4 3341	918
	14	.623 7577	13 7275	1890	.704 5983	9 7810	2150	.305 5413	4 2408	933
	15	-0.610 0302	+13 9127	+1852	-0.714 3793	-9 5635	+2175	-0.309 7821	-4 1464	+ 944
	16	-0.596 1175	+1814	+1814	-0.723 9428	-9 3428	+2208	-0.313 9285	-4 0561	+ 956

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1967.0

Date	X			Y			Z		
Nov. 16	-0.596 1175	+14 0941	+1814	-0.723 9428	- 9 3427	+2208	-0.313 9285	-4 0508	+ 956
17	.582 0234	14 2713	1772	.733 2855	9 1192	2235	.317 9793	3 9538	970
18	.567 7521	14 4446	1733	.742 4047	8 8931	2261	.321 9331	3 8560	978
19	.553 3075	14 6139	1693	.751 2978	8 6641	2290	.325 7891	3 7567	993
20	.538 6936	14 7790	1651	.759 9619	8 4322	2319	.329 5458	3 6564	1003
21	-0.523 9146	+14 9401	+1611	-0.768 3941	- 8 1977	+2345	-0.333 2022	-3 5547	+1017
22	.508 9745	15 0970	1569	.776 5918	7 9606	2371	.336 7569	3 4521	1026
23	.493 8775	15 2497	1527	.784 5524	7 7206	2400	.340 2090	3 3483	1038
24	.478 6278	15 3981	1484	.792 2730	7 4780	2426	.343 5573	3 2431	1052
25	.463 2297	15 5421	1440	.799 7510	7 2326	2454	.346 8004	3 1368	1063
26	-0.447 6876	+15 6817	+1396	-0.806 9836	- 6 9846	+2480	-0.349 9372	-3 0295	+1073
27	.432 0059	15 8163	1346	.813 9682	6 7340	2506	.352 9667	2 9209	1086
28	.416 1896	15 9465	1302	.820 7022	6 4804	2536	.355 8876	2 8109	1100
29	.400 2431	16 0713	1248	.827 1826	6 2249	2555	.358 6985	2 7001	1108
30	.384 1718	16 1912	1199	.833 4075	5 9666	2583	.361 3986	2 5880	1121
Dec. 1	-0.367 9806	+16 3057	+1145	-0.839 3741	- 5 7063	+2603	-0.363 9866	-2 4751	+1129
2	.351 6749	16 4148	1091	.845 0804	5 4436	2627	.366 4617	2 3611	1140
3	.335 2601	16 5184	1036	.850 5240	5 1795	2641	.368 8228	2 2462	1149
4	.318 7417	16 6166	982	.855 7035	4 9134	2661	.371 0690	2 1309	1153
5	.302 1251	16 7092	926	.860 6169	4 6459	2675	.373 1999	2 0146	1163
6	-0.285 4159	+16 7963	+ 871	-0.865 2628	- 4 3773	+2686	-0.375 2145	-1 8979	+1167
7	.268 6196	16 8781	818	.869 6401	4 1073	2700	.377 1124	1 7809	1170
8	.251 7415	16 9546	765	.873 7474	3 8363	2710	.378 8933	1 6631	1178
9	.234 7869	17 0258	712	.877 5837	3 5644	2719	.380 5564	1 5452	1179
10	.217 7611	17 0918	660	.881 1481	3 2914	2730	.382 1016	1 4266	1186
11	-0.200 6693	+17 1525	+ 607	-0.884 4395	- 3 0176	+2738	-0.383 5282	-1 3080	+1186
12	.183 5168	17 2081	556	.887 4571	2 7430	2746	.384 8362	1 1888	1192
13	.166 3087	17 2586	505	.890 2001	2 4677	2753	.386 0250	1 0695	1193
14	.149 0501	17 3038	452	.892 6678	2 1917	2760	.387 0945	9498	1197
15	.131 7463	17 3440	402	.894 8595	1 9152	2765	.388 0443	8301	1197
16	-0.114 4023	+17 3790	+ 350	-0.896 7747	- 1 6380	+2772	-0.388 8744	- 7100	+1201
17	.097 0233	17 4090	300	.898 4127	1 3604	2776	.389 5844	5896	1204
18	.079 6143	17 4339	249	.899 7731	1 0823	2781	.390 1740	4693	1203
19	.062 1804	17 4537	198	.900 8554	8036	2787	.390 6433	3485	1208
20	.044 7267	17 4687	150	.901 6590	5247	2789	.390 9918	2278	1207
21	-0.027 2580	+17 4781	+ 94	-0.902 1837	- 2452	+2795	-0.391 2106	- 1067	+1211
22	-.009 7799	17 4827	+ 46	.902 4289	345	2797	.391 3263	145	1212
23	+ .007 7028	17 4818	- 9	.902 3944	3147	2802	.391 3118	1359	1214
24	.025 1846	17 4758	60	.902 0797	5952	2805	.391 1759	2574	1215
25	.042 6604	17 4642	116	.901 4845	8759	2807	.390 9185	3791	1217
26	+0.060 1246	-17 4471	-171	-0.900 6086	+ 1 1568	+2809	-0.390 5394	+ 5009	+1218
27	.077 5717	17 4245	226	.899 4518	1 4375	2807	.390 0385	6227	1218
28	.094 9962	17 3959	286	.898 0143	1 7181	2806	.389 4158	7445	1218
29	.112 3921	17 3616	343	.896 2962	1 9986	2805	.388 6713	8661	1216
30	.129 7537	17 3216	400	.894 2976	2 2785	2799	.387 8052	9877	1216
31	+0.147 0753	+17 2754	- 462	-0.892 0191	+ 2 5576	+2791	-0.386 8175	+1 1089	+1212
32	+0.164 3507	- 516	-0.889 4615	+2784	-0.385 7086	+1209			

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Jan. 0	+0.147 4020	+17 2632	- 448	-0.891 9397	+ 2 5553	+2767	-0.386 7813	+1 1079	+1199
1	.164 6652	17 2137	495	.889 3844	2 8315	2762	.385 6734	1 2275	1196
2	.181 8789	17 1588	549	.886 5529	3 1072	2757	.384 4459	1 3468	1193
3	.199 0377	17 0987	601	.883 4457	3 3822	2750	.383 0991	1 4660	1192
4	.216 1364	17 0330	657	.880 0635	3 6566	2744	.381 6331	1 5850	1190
5	+0.233 1694	+16 9619	- 711	-0.876 4069	+ 3 9304	+2738	-0.380 0481	+1 7036	+1186
6	.250 1313	16 8853	766	.872 4765	4 2030	2726	.378 3445	1 8218	1182
7	.267 0166	16 8031	822	.868 2735	4 4744	2714	.376 5227	1 9396	1178
8	.283 8197	16 7153	878	.863 7991	4 7448	2704	.374 5831	2 0569	1173
9	.300 5350	16 6219	934	.859 0543	5 0135	2687	.372 5262	2 1736	1167
10	+0.317 1569	+16 5229	- 990	-0.854 0408	+ 5 2806	+2671	-0.370 3526	+2 2895	+1159
11	.333 6798	16 4185	1044	.848 7602	5 5459	2653	.368 0631	2 4047	1152
12	.350 0983	16 3086	1099	.843 2143	5 8094	2635	.365 6584	2 5191	1144
13	.366 4069	16 1937	1149	.837 4049	6 0707	2613	.363 1393	2 6325	1134
14	.382 6006	16 0732	1205	.831 3342	6 3297	2590	.360 5068	2 7450	1125
15	+0.398 6738	+15 9479	-1253	-0.825 0045	+ 6 5867	+2570	-0.357 7618	+2 8566	+1116
16	.414 6217	15 8175	1304	.818 4178	6 8411	2544	.354 9052	2 9671	1105
17	.430 4392	15 6824	1351	.811 5767	7 0932	2521	.351 9381	3 0764	1093
18	.446 1216	15 5424	1400	.804 4835	7 3427	2495	.348 8617	3 1846	1082
19	.461 6640	15 3975	1449	.797 1408	7 5897	2470	.345 6771	3 2918	1072
20	+0.477 0615	+15 2483	-1492	-0.789 5511	+ 7 8340	+2443	-0.342 3853	+3 3978	+1060
21	.492 3098	15 0945	1538	.781 7171	8 0756	2416	.338 9875	3 5025	1047
22	.507 4043	14 9363	1582	.773 6415	8 3144	2388	.335 4850	3 6059	1034
23	.522 3406	14 7739	1624	.765 3271	8 5505	2361	.331 8791	3 7083	1024
24	.537 1145	14 6075	1664	.756 7766	8 7837	2332	.328 1708	3 8093	1010
25	+0.551 7220	+14 4368	-1707	-0.747 9929	+ 9 0143	+2306	-0.324 3615	+3 9091	+ 998
26	.566 1588	14 2622	1746	.738 9786	9 2420	2277	.320 4524	4 0077	986
27	.580 4210	14 0836	1786	.729 7366	9 4672	2252	.316 4447	4 1052	975
28	.594 5046	13 9010	1826	.720 2694	9 6896	2224	.312 3395	4 2015	963
29	.608 4056	13 7144	1866	.710 5798	9 9092	2196	.308 1380	4 2966	951
30	+0.622 1200	+13 5236	-1908	-0.700 6706	+10 1263	+2171	-0.303 8414	+4 3905	+ 939
Feb. 1	.635 6436	13 3285	1951	.690 5443	10 3404	2141	.299 4509	4 4834	929
2	.648 9721	13 1293	1992	.680 2039	10 5516	2112	.294 9675	4 5748	914
3	.662 1014	12 9259	2034	.669 6523	10 7596	2080	.290 3927	4 6652	904
4	.675 0273	12 7183	2076	.658 8927	10 9646	2050	.285 7275	4 7540	888
5	+0.687 7456	+12 5064	-2119	-0.647 9281	+11 1663	+2017	-0.280 9735	+4 8415	+ 875
6	.700 2520	12 2904	2160	.636 7618	11 3641	1978	.276 1320	4 9275	860
7	.712 5424	12 0704	2200	.625 3977	11 5587	1946	.271 2045	5 0119	844
8	.724 6128	11 8463	2241	.613 8390	11 7493	1906	.266 1926	5 0948	829
9	.736 4591	11 6185	2278	.602 0897	11 9360	1867	.261 0978	5 1759	811
10	+0.748 0776	+11 3870	-2315	-0.590 1537	+12 1190	+1830	-0.255 9219	+5 2553	+ 794
11	.759 4646	11 1517	2353	.578 0347	12 2975	1785	.250 6666	5 3330	777
12	.770 6163	10 9132	2385	.565 7372	12 4721	1746	.245 3336	5 4088	758
13	.781 5295	10 6713	2419	.553 2651	12 6426	1705	.239 9248	5 4827	739
14	.792 2008	10 4263	2450	.540 6225	12 8086	1660	.234 4421	5 5549	722
15	+0.802 6271	+10 1783	-2480	-0.527 8139	+12 9705	+1619	-0.228 8872	+5 6251	+ 702
16	+0.812 8054	+10 0000	-2510	-0.514 8434	+13 1263	+1575	-0.223 2621	+5 6840	+ 684

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Feb. 15	+0.812 8054	+ 9 9273	-2510	-0.514 8434	+13 1280	+1575	-0.223 2621	+5 6935	+ 684
16	.822 7327	9 6736	2537	.501 7154	13 2811	1531	.217 5686	5 7599	664
17	.832 4063	9 4173	2563	.488 4343	13 4298	1487	.211 8087	5 8243	644
18	.841 8236	9 1585	2588	.475 0045	13 5742	1444	.205 9844	5 8869	626
19	.850 9821	8 8974	2611	.461 4303	13 7142	1400	.200 0975	5 9475	606
20	+0.859 8795	+ 8 6341	-2633	-0.447 7161	+13 8498	+1356	-0.194 1500	+6 0061	+ 586
21	.868 5136	8 3686	2655	.433 8663	13 9809	1311	.188 1439	6 0630	569
22	.876 8822	8 1014	2672	.419 8854	14 1080	1271	.182 0809	6 1178	548
23	.884 9836	7 8321	2693	.405 7774	14 2308	1228	.175 9631	6 1709	531
24	.892 8157	7 5610	2711	.391 5466	14 3494	1186	.169 7922	6 2222	513
25	+0.900 3767	+ 7 2880	-2730	-0.377 1972	+14 4640	+1146	-0.163 5700	+6 2718	+ 496
26	.907 6647	7 0131	2749	.362 7332	14 5745	1105	.157 2982	6 3196	478
27	.914 6778	6 7361	2770	.348 1587	14 6809	1064	.150 9786	6 3655	459
28	.921 4139	6 4573	2788	.333 4778	14 7831	1022	.144 6131	6 4099	444
Mar. 1	.927 8712	6 1764	2809	.318 6947	14 8811	980	.138 2032	6 4523	424
2	+0.934 0476	+ 5 8935	-2829	-0.303 8136	+14 9748	+ 937	-0.131 7509	+6 4930	+ 407
3	.939 9411	5 6085	2850	.288 8388	15 0638	890	.125 2579	6 5317	387
4	.945 5496	5 3219	2866	.273 7750	15 1485	847	.118 7262	6 5685	368
5	.950 8715	5 0334	2885	.258 6265	15 2284	799	.112 1577	6 6033	348
6	.955 9049	4 7432	2902	.243 3981	15 3034	750	.105 5544	6 6360	327
7	+0.960 6481	+ 4 4515	-2917	-0.228 0947	+15 3737	+ 703	-0.098 9184	+6 6666	+ 306
8	.965 0996	4 1585	2930	.212 7210	15 4392	655	.092 2518	6 6951	285
9	.969 2581	3 8641	2944	.197 2818	15 4995	603	.085 5567	6 7215	264
10	.973 1222	3 5688	2953	.181 7823	15 5549	554	.078 8352	6 7456	241
11	.976 6910	3 2726	2962	.166 2274	15 6054	505	.072 0896	6 7676	220
12	+0.979 9636	+ 2 9753	-2973	-0.150 6220	+15 6508	+ 454	-0.065 3220	+6 7874	+ 198
13	.982 9389	2 6778	2975	.134 9712	15 6912	404	.058 5346	6 8050	176
14	.985 6167	2 3796	2982	.119 2800	15 7266	354	.051 7296	6 8204	154
15	.987 9963	2 0811	2985	.103 5534	15 7570	304	.044 9092	6 8336	132
16	.990 0774	1 7823	2988	.087 7964	15 7824	254	.038 0756	6 8445	109
17	+0.991 8597	+ 1 4836	-2987	-0.072 0140	+15 8029	+ 205	-0.031 2311	+6 8534	+ 89
18	.993 3433	1 1849	2987	.056 2111	15 8185	156	.024 3777	6 8601	67
19	.994 5282	8863	2986	.040 3926	15 8291	106	.017 5176	6 8646	45
20	.995 4145	5883	2980	.024 5635	15 8350	59	.010 6530	6 8669	23
21	.996 0028	2906	2977	-.008 7285	15 8362	12	-.003 7861	6 8673	4
22	+0.996 2934	- 65	-2971	+0.007 1077	+15 8328	- 34	+0.003 0812	+6 8657	- 16
23	.996 2869	3029	2964	.022 9405	15 8249	79	.009 9469	6 8621	36
24	.995 9840	5988	2959	.038 7654	15 8127	122	.016 8090	6 8566	55
25	.995 3852	8941	2953	.054 5781	15 7960	167	.023 6656	6 8493	73
26	.994 4911	1 1888	2947	.070 3741	15 7752	208	.030 5149	6 8401	92
27	+0.993 3023	- 1 4829	-2941	+0.086 1493	+15 7500	- 252	+0.037 3550	+6 8292	- 109
28	.991 8194	1 7766	2937	.101 8993	15 7206	294	.044 1842	6 8164	128
29	.990 0428	2 0698	2932	.117 6199	15 6869	337	.051 0006	6 8018	146
30	.987 9730	2 3626	2928	.133 3068	15 6486	383	.057 8024	6 7852	166
31	.985 6104	2 6546	2920	.148 9554	15 6060	426	.064 5876	6 7669	183
Apr. 1	+0.982 9558	- 2 9463	-2917	+0.164 5614	+15 5586	- 474	+0.071 3545	+6 7465	- 204
2	+0.980 0095	-2908	-2908	+0.180 1200	- 520	- 520	+0.078 1010	- 224	- 224

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950-0

Date		X_{1950}			Y_{1950}			Z_{1950}		
Apr.	1	+0.982 9558		-2917	+0.164 5614	+15 5586	- 474	+0.071 3545	+6 7465	- 204
	2	.980 0095	- 2 9463	2908	.180 1200	15 5066	520	.078 1010	6 7241	224
	3	.976 7724	3 2371	2899	.195 6266	15 4500	566	.084 8251	6 6996	245
	4	.973 2454	3 5270	2888	.211 0766	15 3886	614	.091 5247	6 6733	263
	5	.969 4296	3 8158	2878	.226 4652	15 3225	661	.098 1980	6 6446	287
	6	+0.965 3260	- 4 3901	-2865	+0.241 7877	+15 2516	- 709	+0.104 8426	+6 6142	- 304
	7	.960 9359	4 6750	2849	.257 0393	15 1761	755	.111 4568	6 5814	328
	8	.956 2609	4 9583	2833	.272 2154	15 0960	801	.118 0382	6 5469	345
	9	.951 3026	5 2401	2818	.287 3114	15 0111	849	.124 5851	6 5100	369
	10	.946 0625	5 5198	2797	.302 3225	14 9216	895	.131 0951	6 4714	386
	11	+0.940 5427	- 5 7976	-2778	+0.317 2441	+14 8277	- 939	+0.137 5665	+6 4306	- 408
	12	.934 7451	6 0734	2758	.332 0718	14 7291	986	.143 9971	6 3879	427
	13	.928 6717	6 3469	2735	.346 8009	14 6263	1028	.150 3850	6 3432	447
	14	.922 3248	6 6180	2711	.361 4272	14 5190	1073	.156 7282	6 2967	465
	15	.915 7068	6 8867	2687	.375 9462	14 4073	1117	.163 0249	6 2480	487
	16	+0.908 8201	- 7 1527	-2660	+0.390 3535	+14 2917	-1156	+0.169 2729	+6 1978	- 502
	17	.901 6674	7 4161	2634	.404 6452	14 1719	1198	.175 4707	6 1457	521
	18	.894 2513	7 6767	2606	.418 8171	14 0481	1238	.181 6164	6 0919	538
	19	.886 5746	7 9346	2579	.432 8652	13 9205	1276	.187 7083	6 0363	556
	20	.878 6400	8 1894	2548	.446 7857	13 7893	1312	.193 7446	5 9793	570
	21	+0.870 4506	- 8 4416	-2522	+0.460 5750	+13 6545	-1348	+0.199 7239	+5 9207	- 586
	22	.862 0090	8 6910	2494	.474 2295	13 5162	1383	.205 6446	5 8606	601
	23	.853 3180	8 9376	2466	.487 7457	13 3746	1416	.211 5052	5 7990	616
	24	.844 3804	9 1816	2440	.501 1203	13 2295	1451	.217 3042	5 7362	628
	25	.835 1988	9 4231	2415	.514 3498	13 0811	1484	.223 0404	5 6719	643
	26	+0.825 7757	- 9 6618	-2387	+0.527 4309	+12 9293	-1518	+0.228 7123	+5 6059	- 660
	27	.816 1139	9 8982	2364	.540 3602	12 7740	1553	.234 3182	5 5388	671
	28	.806 2157	10 1318	2336	.553 1342	12 6150	1590	.239 8570	5 4701	687
	29	.796 0839	10 3627	2309	.565 7492	12 4527	1623	.245 3271	5 3997	704
	30	.785 7212	10 5909	2282	.578 2019	12 2865	1662	.250 7268	5 3278	719
May	1	+0.775 1303	-10 8161	-2252	+0.590 4884	+12 1168	-1697	+0.256 0546	+5 2544	- 734
	2	.764 3142	11 0382	2221	.602 6052	11 9435	1733	.261 3090	5 1795	749
	3	.753 2760	11 2571	2189	.614 5487	11 7665	1770	.266 4885	5 1028	767
	4	.742 0189	11 4728	2157	.626 3152	11 5863	1802	.271 5913	5 0248	780
	5	.730 5461	11 6849	2121	.637 9015	11 4023	1840	.276 6161	4 9451	797
	6	+0.718 8612	-11 8936	-2087	+0.649 3038	+11 2150	-1873	+0.281 5612	+4 8640	- 811
	7	.706 9676	12 0986	2050	.660 5188	11 0244	1906	.286 4252	4 7814	826
	8	.694 8690	12 2999	2013	.671 5432	10 8304	1940	.291 2066	4 6972	842
	9	.682 5691	12 4975	1976	.682 3736	10 6332	1972	.295 9038	4 6118	854
	10	.670 0716	12 6910	1935	.693 0068	10 4330	2002	.300 5156	4 5249	869
	11	+0.657 3806	-12 8804	-1894	+0.703 4398	+10 2297	-2033	+0.305 0405	+4 4366	- 883
	12	.644 5002	13 0658	1854	.713 6695	10 0235	2062	.309 4771	4 3472	894
	13	.631 4344	13 2469	1811	.723 6930	9 8145	2090	.313 8243	4 2563	909
	14	.618 1875	13 4238	1769	.733 5075	9 6027	2118	.318 0806	4 1644	919
	15	.604 7637	13 5963	1725	.743 1102	9 3887	2140	.322 2450	4 0714	930
	16	+0.591 1674	-13 7646	-1683	+0.752 4989	+9 1719	-2168	+0.326 3164	+3 9772	- 942
	17	+0.577 4028	-1638	-1638	+0.761 6708	-2187	-2187	+0.330 2936	- 949	

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950.0

Date	X_{1950}			Y_{1950}			Z_{1950}		
May 17	+0.577 4028	-13 9284	-1638	+0.761 6708	+ 8 9532	-2187	+0.330 2936	+3 8823	- 949
18	.563 4744	14 0878	1594	.770 6240	8 7322	2210	.334 1759	3 7862	961
19	.549 3866	14 2432	1554	.779 3562	8 5093	2229	.337 9621	3 6894	968
20	.535 1434	14 3942	1510	.787 8655	8 2844	2249	.341 6515	3 5918	976
21	.520 7492	14 5411	1469	.796 1499	8 0577	2267	.345 2433	3 4935	983
22	+0.506 2081	-14 6840	-1429	+0.804 2076	+ 7 8293	-2284	+0.348 7368	+3 3944	- 991
23	.491 5241	14 8230	1390	.812 0369	7 5989	2304	.352 1312	3 2946	998
24	.476 7011	14 9581	1351	.819 6358	7 3668	2321	.355 4258	3 1940	1006
25	.461 7430	15 0893	1312	.827 0026	7 1328	2340	.358 6198	3 0926	1014
26	.446 6537	15 2163	1270	.834 1354	6 8969	2359	.361 7124	2 9905	1021
27	+0.431 4374	-15 3398	-1235	+0.841 0323	+ 6 6591	-2378	+0.364 7029	+2 8875	-1030
28	.416 0976	15 4588	1190	.847 6914	6 4192	2399	.367 5904	2 7837	1038
29	.400 6388	15 5739	1151	.854 1106	6 1775	2417	.370 3741	2 6790	1047
30	.385 0649	15 6846	1107	.860 2881	5 9338	2437	.373 0531	2 5735	1055
31	.369 3803	15 7908	1062	.866 2219	5 6883	2455	.375 6266	2 4671	1064
June 1	+0.353 5895	-15 8927	-1019	+0.871 9102	+ 5 4410	-2473	+0.378 0937	+2 3601	-1070
2	.337 6968	15 9899	972	.877 3512	5 1922	2488	.380 4538	2 2522	1079
3	.321 7069	16 0826	927	.882 5434	4 9415	2507	.382 7060	2 1435	1087
4	.305 6243	16 1705	879	.887 4849	4 6894	2521	.384 8495	2 0343	1092
5	.289 4538	16 2537	832	.892 1743	4 4359	2535	.386 8838	1 9243	1100
6	+0.273 2001	-16 3320	- 783	+0.896 6102	+ 4 1809	-2550	+0.388 8081	+1 8137	-1106
7	.256 8681	16 4056	736	.900 7911	3 9247	2562	.390 6218	1 7026	1111
8	.240 4625	16 4741	685	.904 7158	3 6673	2574	.392 3244	1 5909	1117
9	.223 9884	16 5374	633	.908 3831	3 4089	2584	.393 9153	1 4787	1122
10	.207 4510	16 5959	585	.911 7920	3 1498	2591	.395 3940	1 3662	1125
11	+0.190 8551	-16 6492	- 533	+0.914 9418	+ 2 8898	-2600	+0.396 7602	+1 2532	-1130
12	.174 2059	16 6974	482	.917 8316	2 6292	2606	.398 0134	1 1401	1131
13	.157 5085	16 7407	433	.920 4608	2 3682	2610	.399 1535	1 0267	1134
14	.140 7678	16 7788	381	.922 8290	2 1069	2613	.400 1802	9134	1133
15	.123 9890	16 8123	335	.924 9359	1 8456	2613	.401 0936	7997	1137
16	+0.107 1767	-16 8406	- 283	+0.926 7815	+ 1 5839	-2617	+0.401 8933	+ 6863	-1134
17	.090 3361	16 8645	239	.928 3654	1 3224	2615	.402 5796	5728	1135
18	.073 4716	16 8836	191	.929 6878	1 0609	2615	.403 1524	4594	1134
19	.056 5880	16 8983	147	.930 7487	7995	2614	.403 6118	3460	1134
20	.039 6897	16 9086	103	.931 5482	5380	2615	.403 9578	2328	1132
21	+0.022 7811	-16 9144	- 58	+0.932 0862	+ 2769	-2611	+0.404 1906	+ 1195	-1133
22	+ .005 8667	16 9161	- 17	.932 3631	154	2615	.404 3101	64	1131
23	- .011 0494	16 9132	+ 29	.932 3785	2458	2612	.404 3165	1067	1131
24	.027 9626	16 9061	71	.932 1327	5071	2613	.404 2098	2199	1132
25	.044 8687	16 8944	117	.931 6256	7686	2615	.403 9899	3332	1133
26	-0.061 7631	-16 8782	+ 162	+0.930 8570	+ 1 0299	-2613	+0.403 6567	+ 4463	-1131
27	.078 6413	16 8576	206	.929 8271	1 2913	2614	.403 2104	5595	1132
28	.095 4989	16 8321	255	.928 5358	1 5525	2612	.402 6509	6727	1132
29	.112 3310	16 8019	302	.926 9833	1 8137	2612	.401 9782	7858	1131
30	.129 1329	16 7670	349	.925 1696	2 0744	2607	.401 1924	8989	1131
July 1	-0.145 8999	-16 7273	+ 397	+0.923 0952	+ 2 3349	-2605	+0.400 2935	+1 0118	-1129
2	-0.162 6272		+ 445	+0.920 7603		-2599	+0.399 2817		-1127

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date		X_{1950}			Y_{1950}			Z_{1950}		
July	1	-0.145 8999	-16 7273	+ 397	+0.923 0952	- 2 3349	-2605	+0.400 2935	-1 0118	-1129
	2	.162 6272	16 6828	445	.920 7603	2 5948	2599	.399 2817	1 1245	1127
	3	.179 3100	16 6333	495	.918 1655	2 8543	2595	.398 1572	1 2370	1125
	4	.195 9433	16 5790	543	.915 3112	3 1132	2589	.396 9202	1 3494	1124
	5	.212 5223	16 5197	593	.912 1980	3 3713	2581	.395 5708	1 4613	1119
	6	-0.229 0420	-16 4555	+ 642	+0.908 8267	- 3 6285	-2572	+0.394 1095	-1 5731	-1118
	7	.245 4975	16 3862	693	.905 1982	3 8849	2564	.392 5364	1 6843	1112
	8	.261 8837	16 3119	743	.901 3133	4 1400	2551	.390 8521	1 7952	1109
	9	.278 1956	16 2326	793	.897 1733	4 3939	2539	.389 0569	1 9054	1102
	10	.294 4282	16 1486	840	.892 7794	4 6463	2524	.387 1515	2 0149	1095
	11	-0.310 5768	-16 0595	+ 891	+0.888 1331	- 4 8972	-2509	+0.385 1366	-2 1240	-1091
	12	.326 6363	15 9659	936	.883 2359	5 1463	2491	.383 0126	2 2321	1081
	13	.342 6022	15 8675	984	.878 0896	5 3936	2473	.380 7805	2 3395	1074
	14	.358 4697	15 7651	1024	.872 6960	5 6391	2455	.378 4410	2 4460	1065
	15	.374 2348	15 6578	1073	.867 0569	5 8827	2436	.375 9950	2 5517	1057
	16	-0.389 8926	-15 5467	+1111	+0.861 1742	- 6 1243	-2416	+0.373 4433	-2 6564	-1047
	17	.405 4393	15 4314	1153	.855 0499	6 3641	2398	.370 7869	2 7603	1039
	18	.420 8707	15 3121	1193	.848 6858	6 6019	2378	.368 0266	2 8634	1031
	19	.436 1828	15 1889	1232	.842 0839	6 8378	2359	.365 1632	2 9654	1020
	20	.451 3717	15 0617	1272	.835 2461	7 0719	2341	.362 1978	3 0669	1015
	21	-0.466 4334	-14 9307	+1310	+0.828 1742	- 7 3040	-2321	+0.359 1309	-3 1674	-1005
	22	.481 3641	14 7958	1349	.820 8702	7 5345	2305	.355 9635	3 2671	997
	23	.496 1599	14 6569	1389	.813 3357	7 7630	2285	.352 6964	3 3661	990
	24	.510 8168	14 5141	1428	.805 5727	7 9898	2268	.349 3303	3 4643	982
	25	.525 3309	14 3673	1468	.797 5829	8 2145	2247	.345 8660	3 5616	973
	26	-0.539 6982	-14 2163	+1510	+0.789 3684	- 8 4374	-2229	+0.342 3044	-3 6583	-967
	27	.553 9145	14 0612	1551	.780 9310	8 6582	2208	.338 6461	3 7538	955
	28	.567 9757	13 9022	1590	.772 2728	8 8768	2186	.334 8923	3 8487	949
	29	.581 8779	13 7389	1633	.763 3960	9 0933	2165	.331 0436	3 9426	939
	30	.595 6168	13 5717	1672	.754 3027	9 3076	2143	.327 1010	4 0354	928
Aug.	31	-0.609 1885	-13 4003	+1714	+0.744 9951	- 9 5192	-2116	+0.323 0656	-4 1274	-920
	1	.622 5888	13 2247	1756	.735 4759	9 7287	2095	.318 9382	4 2181	907
	2	.635 8135	13 0451	1796	.725 7472	9 9355	2068	.314 7201	4 3081	900
	3	.648 8586	12 8613	1838	.715 8117	10 1396	2041	.310 4120	4 3966	885
	4	.661 7199	12 6735	1878	.705 6721	10 3410	2014	.306 0154	4 4842	876
	5	-0.674 3934	-12 4816	+1919	+0.695 3311	-10 5393	-1983	+0.301 5312	-4 5703	-861
	6	.686 8750	12 2857	1959	.684 7918	10 7347	1954	.296 9609	4 6552	849
	7	.699 1607	12 0859	1998	.674 0571	10 9267	1920	.292 3057	4 7386	834
	8	.711 2466	11 8824	2035	.663 1304	11 1154	1887	.287 5671	4 8206	820
	9	.723 1290	11 6752	2072	.652 0150	11 3006	1852	.282 7465	4 9010	804
	10	-0.734 8042	-11 4649	+2103	+0.640 7144	-11 4823	-1817	+0.277 8455	-4 9798	-788
	11	.746 2691	11 2511	2138	.629 2321	11 6606	1783	.272 8657	5 0572	774
	12	.757 5202	11 0342	2169	.617 5715	11 8351	1745	.267 8085	5 1329	757
	13	.768 5544	10 8145	2197	.605 7364	12 0063	1712	.262 6756	5 2070	741
	14	.779 3689	10 5920	2225	.593 7301	12 1738	1675	.257 4686	5 2796	726
	15	-0.789 9609	-10 3666	+2254	+0.581 5563	-12 3380	-1642	+0.252 1890	-5 3507	-711
	16	-0.800 3275	-10 1400	+2280	+0.569 2183	-12 5000	-1607	+0.246 8383	-5 4210	-695

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
 MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Aug. 16	-0.800 3275	-10 1386	+2280	+0.569 2183	-12 4987	-1607	+0.246 8383	-5 4202	-695
17	.810 4661	9 9080	2306	.556 7196	12 6560	1573	.241 4181	5 4882	680
18	.820 3741	9 6746	2334	.544 0636	12 8100	1540	.235 9299	5 5549	667
19	.830 0487	9 4389	2357	.531 2536	12 9605	1505	.230 3750	5 6199	650
20	.839 4876	9 2004	2385	.518 2931	13 1079	1474	.224 7551	5 6838	639
21	-0.848 6880	-8 9593	+2411	+0.505 1852	-13 2517	-1438	+0.219 0713	-5 7460	-622
22	.857 6473	8 7155	2438	.491 9335	13 3921	1404	.213 3253	5 8068	608
23	.866 3628	8 4692	2463	.478 5414	13 5291	1370	.207 5185	5 8661	593
24	.874 8320	8 2201	2491	.465 0123	13 6628	1337	.201 6524	5 9240	579
25	.883 0521	7 9684	2517	.451 3495	13 7925	1297	.195 7284	5 9803	563
26	-0.891 0205	-7 7141	+2543	+0.437 5570	-13 9188	-1263	+0.189 7481	-6 0351	-548
27	.898 7346	7 4573	2568	.423 6382	14 0413	1225	.183 7130	6 0883	532
28	.906 1919	7 1979	2594	.409 5969	14 1601	1188	.177 6247	6 1399	516
29	.913 3898	6 9360	2619	.395 4368	14 2750	1149	.171 4848	6 1898	499
30	.920 3258	6 6716	2644	.381 1618	14 3858	1108	.165 2950	6 2380	482
Sept. 31	-0.926 9974	-6 4047	+2669	+0.366 7760	-14 4929	-1071	+0.159 0570	-6 2845	-465
1	.933 4021	6 1356	2691	.352 2831	14 5956	1027	.152 7725	6 3293	448
2	.939 5377	5 8638	2718	.337 6875	14 6941	985	.146 4432	6 3721	428
3	.945 4015	5 5900	2738	.322 9934	14 7882	941	.140 0711	6 4131	410
4	.950 9915	5 3141	2759	.308 2052	14 8777	895	.133 6580	6 4521	390
5	-0.956 3056	-5 0363	+2778	+0.293 3275	-14 9626	-849	+0.127 2059	-6 4890	-369
6	.961 3419	4 7569	2794	.278 3649	15 0431	805	.120 7169	6 5239	349
7	.966 0988	4 4758	2811	.263 3218	15 1185	754	.114 1930	6 5568	329
8	.970 5746	4 1935	2823	.248 2033	15 1894	709	.107 6362	6 5874	306
9	.974 7681	3 9100	2835	.233 0139	15 2557	663	.101 0488	6 6162	288
10	-0.978 6781	-3 6257	+2843	+0.217 7582	-15 3175	-618	+0.094 4326	-6 6428	-266
11	.982 3038	3 3403	2854	.202 4407	15 3746	571	.087 7898	6 6675	247
12	.985 6441	3 0543	2860	.187 0661	15 4274	528	.081 1223	6 6903	228
13	.988 6984	2 7675	2868	.171 6387	15 4758	484	.074 4320	6 7111	208
14	.991 4659	2 4800	2875	.156 1629	15 5200	442	.067 7209	6 7300	189
15	-0.993 9459	-2 1919	+2881	+0.140 6429	-15 5597	-397	+0.060 9909	-6 7471	-171
16	0.996 1378	1 9031	2888	.125 0832	15 5953	356	.054 2438	6 7624	153
17	0.998 0409	1 6136	2895	.109 4879	15 6266	313	.047 4814	6 7759	135
18	0.999 6545	1 3236	2900	.093 8613	15 6538	272	.040 7055	6 7875	116
19	1.000 9781	1 0330	2906	.078 2075	15 6766	228	.033 9180	6 7974	99
20	-1.002 0111	-7417	+2913	+0.062 5309	-15 6950	-184	+0.027 1206	-6 8054	-80
21	1.002 7528	4499	2918	.046 8359	15 7094	144	.020 3152	6 8115	61
22	1.003 2027	1577	2922	.031 1265	15 7191	97	.013 5037	6 8158	43
23	1.003 3604	1351	2928	+ .015 4074	15 7247	56	+ .006 6879	6 8182	24
24	1.003 2253	4284	2933	- .000 3173	15 7256	-9	- .000 1303	6 8187	-5
25	-1.002 7969	7220	+2936	-0.016 0429	-15 7223	+33	-0.006 9490	-6 8174	+13
26	1.002 0749	1 0159	2939	.031 7652	15 7142	81	.013 7664	6 8140	34
27	1.001 0590	1 3101	2942	.047 4794	15 7016	126	.020 5804	6 8087	53
28	0.999 7489	1 6047	2946	.063 1810	15 6845	171	.027 3891	6 8014	73
29	0.998 1442	1 8991	2944	.078 8655	15 6625	220	.034 1905	6 7921	93
30	-0.996 2451	+2 1938	+2947	-0.094 5280	-15 6357	+268	-0.040 9826	-6 7806	+115
Oct. 1	-0.994 0513	+2 1938	+2944	-0.110 1637	-15 6357	+315	-0.047 7632	-6 7806	+136

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950.0

Date		X_{1950}	Y_{1950}	Z_{1950}
Oct.	1	-0.994 0513 + 2 4882 +2944	-0.110 1637 -15 6042 + 315	-0.047 7632 -6 7670 + 136
	2	.991 5631 + 2 7826 2944	.125 7679 15 5675 367	.054 5302 6 7513 157
	3	.988 7805 3 0763 2937	.141 3354 15 5257 418	.061 2815 6 7333 180
	4	.985 7042 3 3696 2933	.156 8611 15 4790 467	.068 0148 6 7131 202
	5	.982 3346 3 6617 2921	.172 3401 15 4274 516	.074 7279 6 6907 224
	6	-0.978 6729 + 3 9530 +2913	-0.187 7675 -15 3706 + 568	-0.081 4186 -6 6660 + 247
	7	.974 7199 + 4 2427 2897	.203 1381 15 3090 616	.088 0846 6 6392 268
	8	.970 4772 4 5312 2885	.218 4471 15 2428 662	.094 7238 6 6104 288
	9	.965 9460 4 8180 2868	.233 6899 15 1717 711	.101 3342 6 5795 309
	10	.961 1280 5 1032 2852	.248 8616 15 0964 753	.107 9137 6 5466 329
	11	-0.956 0248 + 5 3869 +2837	-0.263 9580 -15 0165 + 799	-0.114 4603 -6 5119 + 347
	12	.950 6379 + 5 6688 2819	.278 9745 14 9324 841	.120 9722 6 4751 368
	13	.944 9691 5 9492 2804	.293 9069 14 8439 885	.127 4473 6 4366 385
	14	.939 0199 6 2278 2786	.308 7508 14 7512 927	.133 8839 6 3964 402
	15	.932 7921 6 5046 2768	.323 5020 14 6544 968	.140 2803 6 3542 422
	16	-0.926 2875 + 6 7798 +2752	-0.338 1564 -14 5532 +1012	-0.146 6345 -6 3102 + 440
	17	.919 5077 + 7 0532 2734	.352 7096 14 4480 1052	.152 9447 6 2646 456
	18	.912 4545 7 3247 2715	.367 1576 14 3387 1093	.159 2093 6 2173 473
	19	.905 1298 7 5946 2699	.381 4963 14 2252 1135	.165 4266 6 1679 494
	20	.897 5352 7 8624 2678	.395 7215 14 1074 1178	.171 5945 6 1169 510
	21	-0.889 6728 + 8 1283 +2659	-0.409 8289 -13 9855 +1219	-0.177 7114 -6 0642 + 527
	22	.881 5445 8 3925 2642	.423 8144 13 8596 1259	.183 7756 6 0097 545
	23	.873 1520 8 6544 2619	.437 6740 13 7295 1301	.189 7853 5 9533 564
	24	.864 4976 8 9143 2599	.451 4035 13 5950 1345	.195 7386 5 8952 581
	25	.855 5833 9 1722 2579	.464 9985 13 4564 1386	.201 6338 5 8352 600
	26	-0.846 4111 + 9 4278 +2556	-0.478 4549 -13 3137 +1427	-0.207 4690 -5 7735 + 617
	27	.836 9833 + 9 6810 2532	.491 7686 13 1666 1471	.213 2425 5 7099 636
	28	.827 3023 9 9319 2509	.504 9352 13 0151 1515	.218 9524 5 6443 656
	29	.817 3704 10 1803 2484	.517 9503 12 8594 1557	.224 5967 5 5770 673
	30	.807 1901 10 4259 2456	.530 8097 12 6993 1601	.230 1737 5 5076 694
	31	-0.796 7642 +10 6686 +2427	-0.543 5090 -12 5347 +1646	-0.235 6813 -5 4363 + 713
Nov.	1	.786 0956 +10 9082 2396	.556 0437 12 3659 1688	.241 1176 5 3632 731
	2	.775 1874 11 1445 2363	.568 4096 12 1929 1730	.246 4808 5 2881 751
	3	.764 0429 11 3773 2328	.580 6025 12 0156 1773	.251 7689 5 2112 769
	4	.752 6656 11 6063 2290	.592 6181 11 8344 1812	.256 9801 5 1324 788
	5	-0.741 0593 +11 8315 +2252	-0.604 4525 -11 6493 +1851	-0.262 1125 -5 0521 + 803
	6	.729 2278 +11 0529 2214	.616 1018 11 4606 1887	.267 1646 4 9701 820
	7	.717 1749 12 2704 2175	.627 5624 11 2684 1922	.272 1347 4 8866 835
	8	.704 9045 12 4840 2136	.638 8308 11 0728 1956	.277 0213 4 8016 850
	9	.692 4205 12 6935 2095	.649 9036 10 8740 1988	.281 8229 4 7152 864
	10	-0.679 7270 +12 8993 +2058	-0.660 7776 -10 6719 +2021	-0.286 5381 -4 6274 + 878
	11	.666 8277 +13 1011 2018	.671 4495 10 4668 2051	.291 1655 4 5385 889
	12	.653 7266 13 2991 1980	.681 9163 10 2585 2083	.295 7040 4 4479 906
	13	.640 4275 13 4932 1941	.692 1748 10 0473 2112	.300 1519 4 3564 915
	14	.626 9343 13 6833 1901	.702 2221 9 8332 2141	.304 5083 4 2635 929
	15	-0.613 2510 +13 8695 +1862	-0.712 0553 -9 6162 +2170	-0.308 7718 -4 1693 + 942
	16	-0.599 3815 +13 8695 +1822	-0.721 6715 -9 6162 +2200	-0.312 9411 -4 1693 + 953

RECTANGULAR COORDINATES FOR 0^h EPHEMERIS TIME
MEAN EQUATOR AND EQUINOX OF 1950-0

Date	X_{1950}			Y_{1950}			Z_{1950}		
Nov. 16	-0.599 3815	+14 0517	+1822	-0.721 6715	- 9 3962	+2200	-0.312 9411	-4 0740	+ 953
17	.585 3298	14 2300	1783	.731 0677	9 1734	2228	.317 0151	3 9775	965
18	.571 0998	14 4043	1743	.740 2411	8 9479	2255	.320 9926	3 8797	978
19	.556 6955	14 5746	1703	.749 1890	8 7195	2284	.324 8723	3 7808	989
20	.542 1209	14 7408	1662	.757 9085	8 4883	2312	.328 6531	3 6807	1001
21	-0.527 3801	+14 9030	+1622	-0.766 3968	- 8 2544	+2339	-0.332 3338	-3 5795	+1012
22	.512 4771	15 0609	1579	.774 6512	8 0179	2365	.335 9133	3 4770	1025
23	.497 4162	15 2147	1538	.782 6691	7 7785	2394	.339 3903	3 3734	1036
24	.482 2015	15 3642	1495	.790 4476	7 5364	2421	.342 7637	3 2685	1049
25	.466 8373	15 5094	1452	.797 9840	7 2916	2448	.346 0322	3 1626	1059
26	-0.451 3279	+15 6499	+1405	-0.805 2756	- 7 0441	+2475	-0.349 1948	-3 0553	+1073
27	.435 6780	15 7858	1359	.812 3197	6 7940	2501	.352 2501	2 9469	1084
28	.419 8922	15 9171	1313	.819 1137	6 5411	2529	.355 1970	2 8373	1096
29	.403 9751	16 0430	1259	.825 6548	6 2858	2553	.358 0343	2 7266	1107
30	.387 9321	16 1641	1211	.831 9406	6 0281	2577	.360 7609	2 6148	1118
Dec. 1	-0.371 7680	+16 2798	+1157	-0.837 9687	- 5 7681	+2600	-0.363 3757	-2 5019	+1129
2	.355 4882	16 3991	1103	.843 7368	5 5061	2620	.365 8776	2 3882	1137
3	.339 0981	16 4949	1048	.849 2429	5 2421	2640	.368 2658	2 2735	1147
4	.322 6032	16 5942	993	.854 4850	4 9765	2656	.370 5393	2 1583	1152
5	.306 0090	16 6881	939	.859 4615	4 7095	2670	.372 6976	2 0422	1161
6	-0.289 3209	+16 7764	+ 883	-0.864 1710	- 4 4409	+2686	-0.374 7398	-1 9257	+1165
7	.272 5445	16 8594	830	.868 6119	4 1715	2694	.376 6655	1 8087	1170
8	.255 6851	16 9372	778	.872 7834	3 9007	2708	.378 4742	1 6911	1176
9	.238 7479	17 0095	723	.876 6841	3 6290	2717	.380 1653	1 5732	1179
10	.221 7384	17 0769	674	.880 3131	3 3563	2727	.381 7385	1 4549	1183
11	-0.204 6615	+17 1387	+ 618	-0.883 6694	- 3 0828	+2735	-0.383 1934	-1 3363	+1186
12	.187 5228	17 1955	568	.886 7522	2 8083	2745	.384 5297	1 2172	1191
13	.170 3273	17 2473	518	.889 5605	2 5333	2750	.385 7469	1 0980	1192
14	.153 0800	17 2938	465	.892 0938	2 2575	2758	.386 8449	9785	1195
15	.135 7862	17 3351	413	.894 3513	1 9810	2765	.387 8234	8587	1198
16	-0.118 4511	+17 3715	+ 364	-0.896 3323	- 1 7040	+2770	-0.388 6821	- 7386	+1201
17	.101 0796	17 4027	312	.898 0363	1 4265	2775	.389 4207	6185	1201
18	.083 6769	17 4289	262	.899 4628	1 1486	2779	.390 0392	4980	1205
19	.066 2480	17 4500	211	.900 6114	8699	2787	.390 5372	3774	1206
20	.048 7980	17 4660	160	.901 4813	5911	2788	.390 9146	2565	1209
21	-0.031 3320	+17 4769	+ 109	-0.902 0724	- 3116	+2795	-0.391 1711	- 1356	+1209
22	.013 8551	17 4827	58	.902 3840	319	2797	.391 3067	144	1212
23	+ .003 6276	17 4831	+ 4	.902 4159	2483	2802	.391 3211	1070	1214
24	.021 1107	17 4783	- 48	.902 1676	5288	2805	.391 2141	2286	1216
25	.038 5890	17 4680	103	.901 6388	8095	2807	.390 9855	3502	1216
26	+0.056 0570	+17 4522	+ 158	-0.900 8293	- 1 0905	+2810	-0.390 6353	- 4720	+1218
27	.073 5092	17 4308	214	.899 7388	1 3712	2807	.390 1633	5940	1220
28	.090 9400	17 4035	273	.898 3676	1 6521	2809	.389 5693	7157	1217
29	.108 3435	17 3705	330	.896 7155	1 9326	2805	.388 8536	8375	1218
30	.125 7140	17 3317	388	.894 7829	2 2126	2800	.388 0161	9591	1216
31	+0.143 0457	+17 2869	+ 448	-0.892 5703	- 2 4921	+2795	-0.387 0570	-1 0803	+1212
32	+0.160 3326	- 504	- 504	-0.890 0782	2 2126	+2783	-0.385 9767	1210	+1210

MEAN LONGITUDE AND ANOMALY ; PRECESSIONAL CONSTANTS

Date	Mean Longitude	Mean Anomaly	Epoch 1967.0	
			Mean obliquity	$\epsilon \ 23^{\circ} 26' 36''.87$ $= 23^{\circ}.44358$
Jan. 0	278.9799	356.6071	$\sin \epsilon$	0.397 84576
10	288.8364	6.4631	$\cos \epsilon$	0.917 45231
20	298.6929	16.3191	$\tan \epsilon$	0.433 64190
30	308.5494	26.1751	$\operatorname{cosec} \epsilon$	2.513 5369
Feb. 9	318.4058	36.0311	$\sec \epsilon$	1.089 9749
19	328.2623	45.8871	$\cot \epsilon$	2.306 0503
Mar. 1	338.1188	55.7431	Annual general precession p	$50''.2713$ $= 0^{\circ}.013 9643$
11	347.9753	65.5991	Annual precession in R.A. m	38.07359
21	357.8317	75.4551	Annual precession in Dec. n	18.33608 $= 20''.0411$
31	7.6882	85.3111	Longitude of axis of rotation Π	$174^{\circ} 33'.8$ $= 174^{\circ}.563$
Apr. 10	17.5447	95.1671	Annual rate of rotation of ecliptic π	$0''.4706$ $= 0^{\circ}.000 1307$
20	27.4012	105.0231	For reduction from	
30	37.2576	114.8791	1967.0 to 1950.0	1950.0 to 1967.0
May 10	47.1141	124.7351	ζ_0	-6' 31''.87 +6' 31''.85
20	56.9706	134.5911	$=$	-268.125 +268.123
30	66.8270	144.4471	z	-6' 31''.85 +6' 31''.87
June 9	76.6835	154.3031	$=$	-268.123 +268.125
19	86.5400	164.1591	$\sin \theta$	-0.001 65181 +0.001 65181
29	96.3965	174.0151	$\tan \frac{1}{2} \theta$	-0.000 82591 +0.000 82591
July 9	106.2529	183.8711	M^s	-528.248 +528.248
19	116.1094	193.7271	N^s	-228.714 +228.714
29	125.9659	203.5832	N''	-340''.71 +340''.71
Aug. 8	135.8224	213.4392	a	-14' 14''.58 +14' 14''.58
18	145.6788	223.2952	$=$	-0°.23738 +0°.23738
28	155.5353	233.1512	b	-8''.00 +8''.00
Sept. 7	165.3918	243.0072	$=$	-0°.002 223 +0°.002 223
17	175.2483	252.8632	c	+5° 23'.8 +5° 38'.0
27	185.1047	262.7192	$=$	+5°.396 +5°.634
Oct. 7	194.9612	272.5752	Formulae :	
17	204.8177	282.4312	α	$= \alpha_0 + M + N \sin \alpha_m \tan \delta_m$
27	214.6741	292.2872	δ	$= \delta_0 + N \cos \alpha_m$
Nov. 6	224.5306	302.1432	λ	$= \lambda_0 + a - b \cos(\lambda_0 + c) \tan \beta_0$
16	234.3871	311.9992	β	$= \beta_0 + b \sin(\lambda_0 + c)$
26	244.2436	321.8552	Ω	$= \Omega_0 + a - b \sin(\Omega_0 + c) \cot i_0$
Dec. 6	254.1000	331.7112	i	$= i_0 + b \cos(\Omega_0 + c)$
16	263.9565	341.5672	ω	$= \omega_0 + b \sin(\Omega_0 + c) \operatorname{cosec} i_0$
26	273.8130	351.4232	where α_m, δ_m are for the mean epoch.	
36	283.6695	1.2792		
Daily motion	0°.985647	0°.985600		
Epoch 1967 January 1.0				
Mean longitude of perigee	Γ	282.37287		
Eccentricity	e	0.0167230		

MEAN EQUATOR, ORBIT, LONGITUDE AND ELONGATION

Date	Mean Equator			Orbit		Mean Longitude	Mean Elongation
	i	Δ	Ω'	Γ'	Ω	ζ	D
Jan. 0	22°353	225°926	-2°773	180°4385	43°3753	143°4449	224°4649
10	22°343	225°373	2°746	181°5525	42°8457	275°2088	346°3724
20	22°333	224°819	2°720	182°6665	42°3162	46°9728	108°2799
30	22°323	224°266	2°693	183°7806	41°7866	178°7368	230°1874
Feb. 9	22°313	223°711	2°667	184°8946	41°2571	310°5007	352°0949
19	22°304	223°157	-2°639	186°0086	40°7276	82°2647	114°0024
Mar. 1	22°294	222°602	2°612	187°1227	40°1980	214°0286	235°9099
11	22°284	222°047	2°584	188°2367	39°6685	345°7926	357°8174
21	22°275	221°492	2°556	189°3508	39°1389	117°5566	119°7248
31	22°266	220°936	2°528	190°4648	38°6094	249°3205	241°6323
Apr. 10	22°256	220°381	-2°500	191°5788	38°0799	21°0845	3°5398
20	22°247	219°825	2°471	192°6929	37°5503	152°8485	125°4473
30	22°238	219°269	2°442	193°8069	37°0208	284°6124	247°3548
May 10	22°229	218°712	2°413	194°9209	36°4913	56°3764	9°2623
20	22°220	218°156	2°384	196°0350	35°9617	188°1404	131°1698
30	22°212	217°599	-2°354	197°1490	35°4322	319°9043	253°0773
June 9	22°203	217°042	2°324	198°2631	34°9026	91°6683	14°9848
19	22°194	216°485	2°294	199°3771	34°3731	223°4323	136°8923
29	22°186	215°928	2°264	200°4911	33°8436	355°1962	258°7998
July 9	22°178	215°371	2°234	201°6052	33°3140	126°9602	20°7073
19	22°170	214°813	-2°203	202°7192	32°7845	258°7242	142°6147
29	22°162	214°255	2°172	203°8332	32°2549	30°4881	264°5222
Aug. 8	22°154	213°697	2°141	204°9473	31°7254	162°2521	26°4297
18	22°146	213°138	2°109	206°0613	31°1959	294°0161	148°3372
28	22°138	212°580	2°078	207°1754	30°6663	65°7800	270°2447
Sept. 7	22°131	212°021	-2°046	208°2894	30°1368	197°5440	32°1522
17	22°123	211°462	2°014	209°4034	29°6073	329°3079	154°0597
27	22°116	210°902	1°982	210°5175	29°0777	101°0719	275°9672
Oct. 7	22°109	210°343	1°949	211°6315	28°5482	232°8359	37°8747
17	22°102	209°783	1°916	212°7455	28°0186	4°5998	159°7822
27	22°095	209°224	-1°884	213°8596	27°4891	136°3638	281°6897
Nov. 6	22°088	208°664	1°851	214°9736	26°9596	268°1278	43°5972
16	22°081	208°104	1°817	216°0876	26°4300	39°8917	165°5046
26	22°074	207°543	1°784	217°2017	25°9005	171°6557	287°4121
Dec. 6	22°068	206°983	1°751	218°3157	25°3709	303°4197	49°3196
16	22°062	206°423	-1°717	219°4298	24°8414	75°1836	171°2271
26	22°055	205°862	1°683	220°5438	24°3119	206°9476	293°1346
36	22°049	205°301	-1°649	221°6578	23°7823	338°7116	55°0421
Daily motion				+0°·111404	-0°·052954	13°·176396	12°·190749

Epoch 1900 January 0·5 E.T.

Eccentricity = 0·05490 0489

Inclination = 5°·145 3964

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Jan. 0.0	141° 19' 55.61"	+5° 03' 31.10"	16' 09.02"	59' 16.455" + 4.239"	U 0 03.2145 ^d 12.4454 ^h
0.5	148 28 31.44	4 56 44.89	16 10.18	59 20.694 2.312	L 0 15.6599 4320
1.0	155 37 19.03	4 45 20.74	16 10.81	59 23.006 + 0.528	U 1 04.0919 4203
1.5	162 45 47.75	4 29 30.06	16 10.95	59 23.534 - 1.092	L 1 16.5122 4109
2.0	169 53 31.54	4 09 29.32	16 10.65	59 22.442 2.545	U 2 04.9231 4039
2.5	177 00 09.23	+3 45 39.42	16 09.96	59 19.897 - 3.835	L 2 17.3270 12.3999
3.0	184 05 24.46	3 18 25.07	16 08.91	59 16.062 4.983	U 3 05.7269 3986
3.5	191 09 05.36	2 48 14.05	16 07.56	59 11.079 6.009	L 3 18.1255 4002
4.0	198 11 03.85	2 15 36.58	16 05.92	59 05.070 6.943	U 4 06.5257 4045
4.5	205 11 14.84	1 41 04.63	16 04.03	58 58.127 7.812	L 4 18.9302 4114
5.0	212 09 35.29	+1 05 11.36	16 01.90	58 50.315 - 8.644	U 5 07.3416 12.4204
5.5	219 06 03.20	+0 28 30.54	15 59.54	58 41.671 9.459	L 5 19.7620 4309
6.0	226 00 36.72	-0 08 23.99	15 56.97	58 32.212 10.275	U 6 08.1929 4426
6.5	232 53 13.33	0 44 58.86	15 54.17	58 21.937 11.095	L 6 20.6355 4544
7.0	239 43 49.22	1 20 41.66	15 51.15	58 10.842 11.919	U 7 09.0899 4652
7.5	246 32 18.85	-1 55 01.51	15 47.90	57 58.923 -12.738	L 7 21.5551 12.4740
8.0	253 18 34.79	2 27 29.53	15 44.43	57 46.185 13.529	U 8 10.0291 4800
8.5	260 02 27.70	2 57 39.36	15 40.74	57 32.656 14.270	L 8 22.5091 4819
9.0	266 43 46.66	3 25 07.58	15 36.85	57 18.386 14.930	U 9 10.9910 4797
9.5	273 22 19.64	3 49 34.15	15 32.79	57 03.456 15.475	L 9 23.4707 4732
10.0	279 57 54.12	-4 10 42.61	15 28.57	56 47.981 -15.875	U 10 11.9439 12.4628
10.5	286 30 17.92	4 28 20.33	15 24.24	56 32.106 16.095	...
11.0	292 59 19.94	4 42 18.50	15 19.86	56 16.011 16.109	L 11 00.4067 4494
11.5	299 24 51.03	4 52 32.05	15 15.47	55 59.902 15.895	U 11 12.8561 4339
12.0	305 46 44.75	4 58 59.46	15 11.14	55 44.007 15.436	L 12 01.2900 4175
12.5	312 04 58.02	-5 01 42.46	15 06.93	55 28.571 -14.721	U 12 13.7075 12.4009
13.0	318 19 31.60	5 00 45.60	15 02.92	55 13.850 13.750	L 13 02.1084 3850
13.5	324 30 30.56	4 56 15.86	14 59.18	55 00.100 12.521	U 13 14.4934 3705
14.0	330 38 04.37	4 48 22.19	14 55.77	54 47.579 11.049	L 14 02.8639 3575
14.5	336 42 27.05	4 37 15.07	14 52.76	54 36.530 9.343	U 14 15.2214 3467
15.0	342 43 57.06	-4 23 06.16	14 50.21	54 27.187 - 7.424	L 15 03.5681 12.3380
15.5	348 42 57.09	4 06 07.88	14 48.19	54 19.763 5.314	U 15 15.9061 3316
16.0	354 39 53.81	3 46 33.26	14 46.74	54 14.449 3.038	L 16 04.2377 3274
16.5	0 35 17.51	3 24 35.65	14 45.91	54 11.411 - 0.623	U 16 16.5651 3258
17.0	6 29 41.69	3 00 28.67	14 45.74	54 10.788 + 1.897	L 17 04.8909 3264
17.5	12 23 42.64	-2 34 26.16	14 46.26	54 12.685 + 4.493	U 17 17.2173 12.3297
18.0	18 17 58.91	2 06 42.26	14 47.48	54 17.178 7.125	L 18 05.5470 3352
18.5	24 13 10.82	1 37 31.44	14 49.43	54 24.303 9.759	U 18 17.8822 3434
19.0	30 09 59.88	1 07 08.74	14 52.08	54 34.062 12.347	L 19 06.2256 3540
19.5	36 09 08.19	0 35 49.96	14 55.45	54 46.409 14.847	U 19 18.5796 3669
20.0	42 11 17.71	-0 03 51.88	14 59.49	55 01.256 +17.208	L 20 06.9465 12.3822
20.5	48 17 09.51	+0 28 27.46	15 04.18	55 18.464 19.376	U 20 19.3287 3994
21.0	54 27 22.89	1 00 48.53	15 09.46	55 37.840 21.296	L 21 07.7281 4182
21.5	60 42 34.35	1 32 50.08	15 15.26	55 59.136 22.907	U 21 20.1463 4376
22.0	67 03 16.52	2 04 09.01	15 21.50	56 22.043 24.151	L 22 08.5839 4569
22.5	73 29 56.97	+2 34 20.33	15 28.08	56 46.194 +24.974	U 22 21.0408 12.4749
23.0	80 02 56.90	+3 02 57.26	15 34.89	57 11.168	L 23 09.5157

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Jan. 23.0	80 02 56.90	+3 02 57.26	15 34.89	57 11.168	L 23 09.5157 ^{d h} 12.4901 ^b
23.5	86 42 29.91	3 29 31.57	15 41.78	57 36.486 +25.318	U 23 22.0058 .5016
24.0	93 28 40.79	3 53 34.05	15 48.64	58 01.634 25.148	L 24 10.5074 .5080
24.5	100 21 24.55	4 14 35.34	15 55.29	58 26.062 24.428	U 24 23.0154 .5093
25.0	107 20 25.66	4 32 06.84	16 01.60	58 49.216 23.154	L 25 11.5247 .5053
25.5	114 25 17.94	+4 45 42.01	16 07.41	59 10.549 +19.004	... ..
26.0	121 35 24.81	4 54 57.61	16 12.59	59 29.553 16.229	U 26 00.0300 ...
26.5	128 50 00.29	4 59 35.06	16 17.01	59 45.782 13.090	L 26 12.5270 12.4970
27.0	136 08 10.69	4 59 21.68	16 20.58	59 58.872 9.697	U 27 01.0124 .4854
27.5	143 28 56.73	4 54 11.60	16 23.22	60 08.569 6.163	L 27 13.4843 .4719
28.0	150 51 16.22	+4 44 06.39	16 24.90	60 14.732 +2.615	U 28 01.9422 .4579
28.5	158 14 06.86	4 29 15.21	16 25.61	60 17.347 -0.833	U 28 14.3867 12.4445
29.0	165 36 28.99	4 09 54.40	16 25.38	60 16.514 4.073	L 29 02.8193 .4326
29.5	172 57 28.01	3 46 26.84	16 24.27	60 12.441 7.017	L 29 15.2419 .4226
30.0	180 16 16.30	3 19 20.77	16 22.36	60 05.424 9.605	U 30 03.6571 .4152
30.5	187 32 14.52	+2 49 08.57	16 19.75	59 55.819 -11.796	L 30 16.0676 .4105
31.0	194 44 52.20	2 16 25.39	16 16.53	59 44.023 13.577	U 31 04.4761 12.4085
31.5	201 53 47.76	1 41 47.87	16 12.83	59 30.446 14.955	L 31 16.8853 .4092
Feb. 1.0	208 58 47.89	1 05 53.02	16 08.76	59 15.491 15.957	U 1 05.2979 .4126
1.5	215 59 46.64	+0 29 17.21	16 04.41	58 59.534 16.620	L 1 17.7162 .4183
2.0	222 56 44.17	-0 07 24.51	15 59.88	58 42.914 -16.991	U 2 06.1419 .4257
2.5	229 49 45.37	0 43 38.95	15 55.25	58 25.923 17.122	U 2 18.5766 12.4347
3.0	236 38 58.44	1 18 55.18	15 50.59	58 08.801 17.063	L 2 18.5766 .4443
3.5	243 24 33.66	1 52 44.71	15 45.94	57 51.738 16.859	U 3 07.0209 .4537
4.0	250 06 42.10	2 24 41.67	15 41.35	57 34.879 16.556	L 3 19.4746 .4622
4.5	256 45 34.72	-2 54 22.87	15 36.84	57 18.323 -16.185	U 4 07.9368 .4687
5.0	263 21 21.56	3 21 27.85	15 32.43	57 02.138 15.774	L 4 20.4055 .4516
5.5	269 54 11.20	3 45 38.98	15 28.13	56 46.364 15.341	U 5 08.8778 12.4723
6.0	276 24 10.42	4 06 41.44	15 23.95	56 31.023 14.894	L 5 21.3504 .4726
6.5	282 51 24.11	4 24 23.28	15 19.89	56 16.129 14.437	U 6 09.8194 .4690
7.0	289 15 55.35	-4 38 35.46	15 15.96	56 01.692 -13.963	L 6 22.2813 .4619
7.5	295 37 45.71	4 49 11.83	15 12.15	55 47.729 13.463	U 7 10.7329 12.4388
8.0	301 56 55.63	4 56 09.13	15 08.49	55 34.266 12.922	L 7 23.1717 .4243
8.5	308 13 24.99	4 59 26.86	15 04.97	55 21.344 12.322	U 8 11.5960 .4092
9.0	314 27 13.68	4 59 07.25	15 01.61	55 09.022 11.645	... ..
9.5	320 38 22.24	-4 55 15.01	14 58.44	54 57.377 -10.868	L 9 00.0052 .3941
10.0	326 46 52.49	4 47 57.13	14 55.48	54 46.509 9.977	U 9 12.3993 12.3795
10.5	332 52 48.11	4 37 22.68	14 52.76	54 36.532 8.952	L 10 00.7788 .3663
11.0	338 56 15.14	4 23 42.42	14 50.32	54 27.580 7.782	U 10 13.1451 .3546
11.5	344 57 22.44	4 07 08.59	14 48.20	54 19.798 6.454	L 11 01.4997 .3446
12.0	350 56 21.98	-3 47 54.57	14 46.44	54 13.344 -4.965	U 11 13.8443 .3366
12.5	356 53 29.07	3 26 14.62	14 45.09	54 08.379 3.311	L 12 02.1809 12.3307
13.0	2 49 02.53	3 02 23.65	14 44.18	54 05.068 -1.497	U 12 14.5116 .3270
13.5	8 43 24.64	2 36 37.00	14 43.78	54 03.571 +0.473	L 13 02.8386 .3255
14.0	14 37 01.12	2 09 10.35	14 43.91	54 04.044 2.585	U 13 15.1641 .3261
14.5	20 30 21.00	-1 40 19.59	14 44.61	54 06.629 +4.824	L 14 03.4902 .3290
15.0	26 23 56.37	-1 10 20.83	14 45.92	54 11.453	U 14 15.8192 12.3343
					L 15 04.1535

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Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Feb. 15.0	26° 23' 56".37	-1° 10' 20".83	14' 45".92	54' 11".453	L 15 04.1535 ^{d h}
15.5	32 18 22.13	0 39 30.42	14 47.88	54 18.625 + 7.172	U 15 16.4952 ^h
16.0	38 14 15.57	-0 08 05.07	14 50.49	54 28.226 9.601	L 16 04.8467 12.3417
16.5	44 12 15.98	+0 23 38.04	14 53.79	54 40.307 12.081	U 16 17.2101 3515
17.0	50 13 04.07	0 55 21.07	14 57.76	54 54.882 14.575	L 17 05.5876 3634
17.5	56 17 21.38	+1 26 45.30	15 02.40	55 11.926 17.044	U 17 17.9810 3775
18.0	62 25 49.46	1 57 30.96	15 07.69	55 31.359 +19.433	L 18 06.3917 3934
18.5	68 39 08.97	2 27 17.02	15 13.60	55 53.051 21.692	U 18 18.8205 12.4107
19.0	74 57 58.62	2 55 41.08	15 20.08	56 16.803 23.752	L 19 07.2675 4288
19.5	81 22 53.87	3 22 19.28	15 27.04	56 42.350 25.547	U 19 19.7317 4470
20.0	87 54 25.59	+3 46 46.43	15 34.39	57 09.352 27.002	L 20 08.2110 4642
20.5	94 32 58.44	4 08 36.18	15 42.03	57 37.389 +28.037	U 20 20.7023 4793
21.0	101 18 49.29	4 27 21.56	15 49.82	58 05.967 28.578	L 21 09.2015 12.4913
21.5	108 12 05.52	4 42 35.61	15 57.60	58 34.517 28.550	U 21 21.7040 4992
22.0	115 12 43.60	4 53 52.39	16 05.19	59 02.409 27.892	L 22 10.2052 5025
22.5	122 20 27.87	+5 00 48.22	16 12.43	59 28.969 26.560	U 22 22.7010 5012
23.0	129 34 49.89	5 03 03.02	16 19.11	59 53.504 +24.535	L 23 11.1883 4958
23.5	136 55 08.41	5 00 21.85	16 25.06	60 15.333 21.829	U 23 23.6651 4768
24.0	144 20 30.17	4 52 36.37	16 30.10	60 33.823 18.490	L 24 12.1304 4653
24.5	151 49 51.58	4 39 45.96	16 34.08	60 48.431 14.608	...
25.0	159 22 01.21	+4 21 58.59	16 36.89	60 58.731 10.300	U 25 00.5846 ...
25.5	166 55 42.89	3 59 30.99	16 38.44	61 04.453 + 5.722	L 25 13.0287 12.4441
26.0	174 29 39.20	3 32 48.26	16 38.73	61 05.493 + 1.040	U 26 01.4646 4359
26.5	182 02 35.01	3 02 22.84	16 37.76	61 01.922 - 3.571	L 26 13.8943 4297
27.0	189 33 20.68	2 28 52.97	16 35.59	60 53.976 7.946	U 27 02.3205 4262
27.5	197 00 54.68	+1 53 00.84	16 32.34	60 42.033 11.943	L 27 14.7456 4251
28.0	204 24 25.46	1 15 30.61	16 28.13	60 26.587 -15.446	U 28 03.1721 12.4265
28.5	211 43 12.45	+0 37 06.57	16 23.12	60 08.208 18.379	L 28 15.6023 4302
Mar. 1.0	218 56 46.30	-0 01 28.54	16 17.48	59 47.503 20.705	U 1 04.0381 4358
1.5	226 04 48.40	0 39 34.70	16 11.37	59 25.087 22.416	L 1 16.4810 4429
2.0	233 07 09.90	-1 16 35.55	16 04.96	59 01.549 23.538	U 2 04.9319 4509
2.5	240 03 50.39	1 51 58.87	15 58.39	58 37.432 -24.117	L 2 17.3908 12.4589
3.0	246 54 56.36	2 25 16.71	15 51.79	58 13.216 24.216	U 3 05.8569 4661
3.5	253 40 39.71	2 56 05.41	15 45.28	57 49.311 23.905	L 3 18.3285 4716
4.0	260 21 16.19	3 24 05.31	15 38.94	57 26.050 23.261	U 4 06.8033 4748
4.5	266 57 04.13	-3 49 00.50	15 32.85	57 03.698 22.352	L 4 19.2780 4747
5.0	273 28 23.25	4 10 38.43	15 27.06	56 42.450 -21.248	U 5 07.7493 12.4713
5.5	279 55 33.66	4 28 49.63	15 21.61	56 22.442 20.008	L 5 20.2138 4645
6.0	286 18 55.12	4 43 27.37	15 16.52	56 03.758 18.684	U 6 08.6685 4547
6.5	292 38 46.47	4 54 27.45	15 11.80	55 46.440 17.318	L 6 21.1109 4424
7.0	298 55 25.25	-5 01 47.98	15 07.46	55 30.499 15.941	U 7 09.5394 4285
7.5	305 09 07.47	5 05 29.23	15 03.49	55 15.919 -14.580	L 7 21.9530 12.4136
8.0	311 20 07.59	5 05 33.49	14 59.88	55 02.670 13.249	U 8 10.3517 3987
8.5	317 28 38.55	5 02 04.99	14 56.62	54 50.711 11.959	L 8 22.7360 3843
9.0	323 34 52.03	4 55 09.81	14 53.70	54 40.003 10.708	U 9 11.1068 3708
9.5	329 38 58.66	-4 44 55.78	14 51.12	54 30.509 9.494	L 9 23.4656 3588
10.0	335 41 08.41	-4 31 32.39	14 48.85	54 22.200 - 8.309	U 10 11.8141 12.3485

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Mar. 10-0	335 41 08.41	-4 31 32.39	14 48.85	54 22.200	U 10 11.8141 ^h
10-5	341 41 31.02	4 15 10.70	14 46.91	54 15.064 - 7.136	... 12.3398
11-0	347 40 16.37	3 56 03.12	14 45.28	54 09.103 5.961	L 11 00.1539 ...
11-5	353 37 34.93	3 34 23.37	14 43.99	54 04.335 4.768	U 11 12.4870 .3331
12-0	359 33 38.23	3 10 26.21	14 43.02	54 00.800 3.535	L 12 00.8155 .3285
12-5	5 28 39.16	-2 44 27.34	14 42.41	53 58.553 2.247	U 12 13.1413 .3258
13-0	11 22 52.38	2 16 43.17	14 42.17	53 57.665 - 0.888	L 13 01.4665 12.3252
13-5	17 16 34.57	1 47 30.72	14 42.32	53 58.224 + 0.559	U 13 13.7932 .3267
14-0	23 10 04.69	1 17 07.47	14 42.89	54 00.326 2.102	L 14 02.1233 .3301
14-5	29 03 44.09	0 45 51.21	14 43.91	54 04.077 3.751	U 14 14.4590 .3357
15-0	34 57 56.63	-0 14 00.03	14 45.41	54 09.583 5.506	L 15 02.8023 .3433
15-5	40 53 08.67	+0 18 07.78	14 47.42	54 16.954 + 7.371	U 15 15.1552 12.3529
16-0	46 49 49.01	0 50 13.68	14 49.97	54 26.289 9.335	L 16 03.5195 .3643
16-5	52 48 28.68	1 21 58.85	14 53.07	54 37.678 11.389	U 16 15.8969 .3774
17-0	58 49 40.73	1 53 04.12	14 56.75	54 51.190 13.512	L 17 04.2890 .3921
17-5	64 53 59.84	+2 23 09.89	15 01.02	55 06.870 15.680	U 17 16.6966 .4076
18-0	71 02 01.78	2 51 56.01	15 05.89	55 24.730 +17.860	L 18 05.1203 12.4237
18-5	77 14 22.84	3 19 01.66	15 11.34	55 44.743 20.013	U 18 17.5598 .4395
19-0	83 31 38.97	3 44 05.37	15 17.36	56 06.829 22.086	L 19 06.0139 .4541
19-5	89 54 24.86	4 06 44.93	15 23.90	56 30.851 24.022	U 19 18.4808 .4669
20-0	96 23 12.78	+4 26 37.56	15 30.92	56 56.606 25.755	L 20 06.9575 .4767
20-5	102 58 31.27	4 43 20.08	15 38.33	57 23.813 +27.207	U 20 19.4408 12.4833
21-0	109 40 43.67	4 56 29.35	15 46.04	57 52.111 28.298	L 21 07.9269 .4861
21-5	116 30 06.49	5 05 42.85	15 53.93	58 21.051 28.940	U 21 20.4121 .4852
22-0	123 26 47.83	5 10 39.50	16 01.84	58 50.101 29.050	L 22 08.8933 .4812
22-5	130 30 45.85	+5 11 00.73	16 09.62	59 18.648 28.547	U 22 21.3681 .4748
23-0	137 41 47.42	5 06 31.73	16 17.07	59 46.013 +27.365	L 23 09.8348 12.4667
23-5	144 59 27.23	4 57 02.81	16 24.01	60 11.475 25.462	U 23 22.2931 .4583
24-0	152 23 07.47	4 42 30.76	16 30.23	60 34.293 22.818	L 24 10.7433 .4502
24-5	159 51 58.19	4 23 00.11	16 35.53	60 53.754 19.461	U 24 23.1864 .4431
25-0	167 24 58.48	+3 58 43.94	16 39.74	61 09.210 15.456	L 25 11.6242 .4378
25-5	175 00 58.48	3 30 04.25	16 42.71	61 20.121 +10.911	U 25 11.6242 12.4346
26-0	182 38 42.08	2 57 31.73	16 44.34	61 26.098 5.977	... .3331
26-5	190 16 50.10	2 21 44.69	16 44.57	61 26.932 + 0.834	U 26 00.0588 .4338
27-0	197 54 03.68	1 43 27.53	16 43.39	61 22.611 - 4.321	L 26 12.4926 .4353
27-5	205 29 07.60	+1 03 28.65	16 40.86	61 13.317 9.294	U 27 00.9279 .4393
28-0	213 00 53.17	+0 22 38.13	16 37.07	60 59.416 -13.901	L 27 13.3672 12.4454
28-5	220 28 20.52	-0 18 14.54	16 32.17	60 41.422 17.994	U 28 01.8126 .4531
29-0	227 50 40.21	0 58 22.51	16 26.32	60 19.963 21.459	L 28 14.2657 .4619
29-5	235 07 13.98	1 37 03.16	16 19.72	59 55.737 24.226	U 29 02.7276 .4710
30-0	242 17 34.88	-2 13 39.22	16 12.57	59 29.467 26.270	L 29 15.1986 .4795
30-5	249 21 26.78	2 47 39.31	16 05.05	59 01.863 -27.604	U 30 03.6781 12.4863
31-0	256 18 43.41	3 18 38.09	15 57.34	58 33.598 28.265	L 30 16.1644 .4905
31-5	263 09 27.15	3 46 15.99	15 49.63	58 05.275 28.323	U 31 04.6549 .4911
Apr. 1-0	269 53 47.64	4 10 18.72	15 42.04	57 37.423 27.852	L 31 17.1460 .4881
1-5	276 32 00.41	-4 30 36.65	15 34.70	57 10.486 26.937	U 1 05.6341 .4811
2-0	283 04 25.47	-4 47 04.12	15 27.71	56 44.822 -25.664	L 1 18.1152 12.4704
					U 2 06.5856

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Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Apr. 1.0	269° 53' 47.64	-4° 10' 18.72	15' 42.04	57' 37.423	U 1 05.6341 ^{d h}
1.5	276 32 00.41	4 30 36.65	15 34.70	57 10.486 -26.937	L 1 18.1152 ^h 12.4811
2.0	283 04 25.47	4 47 04.12	15 27.71	56 44.822 25.664	U 2 06.5856 .4704
2.5	289 31 26.10	4 59 38.81	15 21.14	56 20.708 24.114	L 2 19.0427 .4571
3.0	295 53 27.71	5 08 21.12	15 15.05	55 58.348 22.360	U 3 07.4843 .4416
				20.471	12.4252
3.5	302 10 56.94	-5 13 13.71	15 09.47	55 37.877 -18.502	L 3 19.9095 12.4085
4.0	308 24 20.80	5 14 21.07	15 04.43	55 19.375 16.502	U 4 08.3180 .3925
4.5	314 34 06.13	5 11 49.24	14 59.93	55 02.873 14.510	L 4 20.7105 .3776
5.0	320 40 39.04	5 05 45.57	14 55.98	54 48.363 12.556	U 5 09.0881 .3640
5.5	326 44 24.62	4 56 18.61	14 52.56	54 35.807 10.663	L 5 21.4521 .3525
6.0	332 45 46.66	-4 43 38.01	14 49.65	54 25.144 -8.848	U 6 09.8046 12.3427
6.5	338 45 07.59	4 27 54.46	14 47.24	54 16.296 7.118	L 6 22.1473 .3350
7.0	344 42 48.41	4 09 19.73	14 45.30	54 09.178 5.477	U 7 10.4823 .3294
7.5	350 39 08.74	3 48 06.58	14 43.81	54 03.701 3.922	L 7 22.8117 .3259
8.0	356 34 26.97	3 24 28.81	14 42.74	53 59.779 2.446	U 8 11.1376 .3244
8.5	2 29 00.47	-2 58 41.22	14 42.08	53 57.333 -1.037	L 8 23.4620 12.3251
9.0	8 23 05.76	2 30 59.56	14 41.80	53 56.296 +0.316	U 9 11.7871 .3276
9.5	14 16 58.81	2 01 40.50	14 41.88	53 56.612 1.633	... ..
10.0	20 10 55.33	1 31 01.51	14 42.33	53 58.245 2.927	L 10 00.1147 .3323
10.5	26 05 11.03	0 59 20.82	14 43.12	54 01.172 4.218	U 10 12.4470 .3389
11.0	32 00 01.93	-0 26 57.29	14 44.27	54 05.390 +5.522	L 11 00.7859 12.3474
11.5	37 55 44.65	+0 05 49.70	14 45.78	54 10.912 6.854	U 11 13.1333 .3577
12.0	43 52 36.64	0 38 40.33	14 47.64	54 17.766 8.227	L 12 01.4910 .3696
12.5	49 50 56.38	1 11 14.51	14 49.89	54 25.993 9.653	U 12 13.8606 .3827
13.0	55 51 03.56	1 43 11.90	14 52.52	54 35.646 11.135	L 13 02.2433 .3969
13.5	61 53 19.15	+2 14 12.05	14 55.55	54 46.781 +12.674	U 13 14.6402 12.4115
14.0	67 58 05.44	2 43 54.43	14 59.00	54 59.455 14.264	L 14 03.0517 .4260
14.5	74 05 45.95	3 11 58.48	15 02.89	55 13.719 15.893	U 14 15.4777 .4395
15.0	80 16 45.28	3 38 03.68	15 07.22	55 29.612 17.540	L 15 03.9172 .4515
15.5	86 31 28.79	4 01 49.60	15 12.00	55 47.152 19.177	U 15 16.3687 .4609
16.0	92 50 22.23	+4 22 55.94	15 17.22	56 06.329 +20.768	L 16 04.8296 12.4676
16.5	99 13 51.17	4 41 02.66	15 22.88	56 27.097 22.267	U 16 17.2972 .4709
17.0	105 42 20.32	4 55 50.17	15 28.95	56 49.364 23.616	L 17 05.7681 .4709
17.5	112 16 12.69	5 06 59.53	15 35.38	57 12.980 24.754	U 17 18.2390 .4679
18.0	118 55 48.61	5 14 12.86	15 42.12	57 37.734 25.605	L 18 06.7069 .4627
18.5	125 41 24.64	+5 17 13.82	15 49.10	58 03.339 +26.096	U 18 19.1696 12.4559
19.0	132 33 12.32	5 15 48.23	15 56.21	58 29.435 26.145	L 19 07.6255 .4483
19.5	139 31 16.97	5 09 44.92	16 03.33	58 55.580 25.679	U 19 20.0738 .4408
20.0	146 35 36.44	4 58 56.58	16 10.33	59 21.259 24.628	L 20 08.5146 .4343
20.5	153 46 00.05	4 43 20.84	16 17.04	59 45.887 22.943	U 20 20.9489 .4292
21.0	161 02 07.72	+4 23 01.22	16 23.29	60 08.830 +20.597	L 21 09.3781 12.4261
21.5	168 23 29.46	3 58 08.13	16 28.90	60 29.427 17.592	U 21 21.8042 .4254
22.0	175 49 25.41	3 28 59.47	16 33.69	60 47.019 13.973	L 22 10.2296 .4271
22.5	183 19 06.26	2 56 00.97	16 37.50	61 00.992 9.819	U 22 22.6567 .4314
23.0	190 51 34.43	2 19 46.01	16 40.18	61 10.811 5.251	L 23 11.0881 .4383
23.5	198 25 45.72	+1 40 54.80	16 41.61	61 16.062 +0.422	U 23 23.5264 12.4475
24.0	206 00 31.49	+1 00 13.10	16 41.72	61 16.484	L 24 11.9739

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Apr. 24.0	206° 00' 31".49	+1° 00' 13".10	16' 41".72	61' 16".484	L 24 11.9739 ^{d h} 12.4584 ^b
24.5	213 34 41.16	+0 18 30.33	16 40.50	61 11.991 - 4.493	... ...
25.0	221 07 04.91	-0 23 22.57	16 37.96	61 02.682 9.309	U 25 00.4323 ...
25.5	228 36 36.24	1 04 35.37	16 34.19	60 48.837 13.845	L 25 12.9028 .4705
26.0	236 02 14.34	1 44 20.72	16 29.30	60 30.889 17.948	U 26 01.3855 .4827
				21.486	.4939
26.5	243 23 06.09	-2 21 55.92	16 23.45	60 09.403	L 26 13.8794
27.0	250 38 27.43	2 56 44.24	16 16.81	59 45.031 -24.372	U 27 02.3824 12.5030
27.5	257 47 44.26	3 28 15.66	16 09.57	59 18.473 26.558	L 27 14.8909 .5085
28.0	264 50 32.68	3 56 07.12	16 01.93	58 50.440 28.033	U 28 03.4004 .5095
28.5	271 46 38.86	4 20 02.29	15 54.08	58 21.622 28.818	L 28 15.9061 .5057
				28.961	.4969
29.0	278 35 58.40	-4 39 51.00	15 46.19	57 52.661	U 29 04.4030
29.5	285 18 35.41	4 55 28.42	15 38.42	57 24.131 -28.530	L 29 16.8870 12.4840
30.0	291 54 41.48	5 06 54.27	15 30.90	56 56.531 27.600	U 30 05.3547 .4677
30.5	298 24 34.43	5 14 11.84	15 23.75	56 30.280 26.251	L 30 17.8041 .4494
May 1.0	304 48 37.15	5 17 27.24	15 17.05	56 05.714 24.566	U 1 06.2344 .4303
				22.620	.4114
1.5	311 07 16.46	-5 16 48.70	15 10.89	55 43.094	L 1 18.6458
2.0	317 21 02.03	5 12 25.97	15 05.31	55 22.610 -20.484	U 2 07.0392 12.3934
2.5	323 30 25.45	5 04 29.89	15 00.35	55 04.388 18.222	L 2 19.4162 .3770
3.0	329 35 59.38	4 53 12.12	14 56.02	54 48.499 15.889	U 3 07.7788 .3626
3.5	335 38 16.87	4 38 44.86	14 52.33	54 34.966 13.533	L 3 20.1292 .3504
				11.192	.3405
4.0	341 37 50.77	-4 21 20.86	14 49.28	54 23.774	U 4 08.4697
4.5	347 35 13.24	4 01 13.29	14 46.86	54 14.870 - 8.904	L 4 20.8025 12.3328
5.0	353 30 55.36	3 38 35.82	14 45.03	54 08.179 6.691	U 5 09.1301 .3276
5.5	359 25 26.86	3 13 42.66	14 43.79	54 03.602 4.577	L 5 21.4546 .3245
6.0	5 19 15.88	2 46 48.65	14 43.08	54 01.026 2.576	U 6 09.7785 .3239
				- 0.699	.3253
6.5	11 12 48.87	-2 18 09.35	14 42.89	54 00.327	L 6 22.1038
7.0	17 06 30.43	1 48 01.09	14 43.18	54 01.377 + 1.050	U 7 10.4329 12.3291
7.5	23 00 43.39	1 16 41.05	14 43.91	54 04.046 2.669	L 7 22.7676 .3347
8.0	28 55 48.73	0 44 27.26	14 45.04	54 08.207 4.161	U 8 11.1102 .3426
8.5	34 52 05.71	-0 11 38.62	14 46.55	54 13.741 5.534	L 8 23.4625 .3523
				6.796	.3638
9.0	40 49 51.94	+0 21 25.15	14 48.40	54 20.537	U 9 11.8263
9.5	46 49 23.55	0 54 23.61	14 50.57	54 28.500 + 7.963	... ... 12.3767
10.0	52 50 55.37	1 26 55.72	14 53.03	54 37.545 9.045	L 10 00.2030 ...
10.5	58 54 41.10	1 58 39.95	14 55.77	54 47.607 10.062	U 10 12.5939 .3909
11.0	65 00 53.57	2 29 14.54	14 58.78	54 58.634 11.027	L 11 00.9994 .4055
				11.958	.4202
11.5	71 09 44.89	+2 58 17.64	15 02.04	55 10.592	U 11 13.4196
12.0	77 21 26.71	3 25 27.58	15 05.54	55 23.460 +12.868	L 12 01.8538 12.4342
12.5	83 36 10.36	3 50 23.08	15 09.29	55 37.229 13.769	U 12 14.3003 .4465
13.0	89 54 07.03	4 12 43.50	15 13.29	55 51.895 14.666	L 13 02.7569 .4566
13.5	96 15 27.85	4 32 09.09	15 17.53	56 07.456 15.561	U 13 15.2204 .4635
				16.451	.4670
14.0	102 40 23.90	+4 48 21.23	15 22.01	56 23.907	L 14 03.6874
14.5	109 09 06.19	5 01 02.67	15 26.73	56 41.228 +17.321	U 14 16.1545 12.4671
15.0	115 41 45.47	5 09 57.79	15 31.68	56 59.381 18.153	L 15 04.6182 .4637
15.5	122 18 31.99	5 14 52.94	15 36.83	57 18.300 18.919	U 15 17.0761 .4579
16.0	128 59 35.16	5 15 36.75	15 42.17	57 37.882 19.582	L 16 05.5261 .4500
				20.098	.4412
16.5	135 45 03.02	+5 12 00.46	15 47.64	57 57.980	U 16 17.9673
17.0	142 35 01.68	+5 03 58.44	15 53.20	58 18.395 +20.415	L 17 06.3997 12.4324

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
May 17-0	142° 35' 01.68	+5° 03' 58.44	15' 53.20	58' 18.395	L 17 06.3997 ^{d h}
17-5	149 29 34.61	4 51 28.62	15 58.78	58 38.872	U 17 18.8238 ^h
18-0	156 28 41.88	4 34 33.04	16 04.29	58 59.096	L 18 07.2412
18-5	163 32 19.33	4 13 18.39	16 09.63	59 18.697	U 18 19.6536
19-0	170 40 17.84	3 47 56.50	16 14.69	59 37.249	L 19 08.0634
19-5	177 52 22.54	+3 18 44.83	16 19.33	59 54.290	U 19 20.4732
20-0	185 08 12.25	2 46 06.68	16 23.43	60 09.331	L 20 08.8857
20-5	192 27 19.14	2 10 31.25	16 26.85	60 21.879	U 20 21.3039
21-0	199 49 08.59	1 32 33.32	16 29.46	60 31.468	L 21 09.7304
21-5	207 12 59.52	0 52 52.62	16 31.15	60 37.682	U 21 22.1679
22-0	214 38 05.02	+0 12 12.73	16 31.83	60 40.187	L 22 10.6184
22-5	222 03 33.45	-0 28 40.28	16 31.44	60 38.758	U 22 23.0835
23-0	229 28 29.87	1 08 59.55	16 29.96	60 33.298	L 23 11.5638
23-5	236 51 57.80	1 47 59.26	16 27.38	60 23.849	... ..
24-0	244 13 01.19	2 24 56.37	16 23.77	60 10.592	U 24 00.0583
24-5	251 30 46.43	-2 59 12.24	16 19.21	59 53.841	L 24 12.5651
25-0	258 44 24.26	3 30 13.87	16 13.81	59 34.023	U 25 01.0804
25-5	265 53 11.52	3 57 34.73	16 07.71	59 11.653	L 25 13.5994
26-0	272 56 32.47	4 20 55.08	16 01.08	58 47.303	U 26 02.1164
26-5	279 53 59.75	4 40 01.95	15 54.07	58 21.575	L 26 14.6256
27-0	286 45 14.84	-4 54 48.62	15 46.85	57 55.073	U 27 03.1219
27-5	293 30 08.14	5 05 13.94	15 39.58	57 28.378	L 27 15.6014
28-0	300 08 38.69	5 11 21.46	15 32.40	57 02.030	U 28 04.0614
28-5	306 40 53.49	5 13 18.47	15 25.45	56 36.516	L 28 16.5007
29-0	313 07 06.71	5 11 15.14	15 18.84	56 12.261	U 29 04.9195
29-5	319 27 38.74	-5 05 23.70	15 12.67	55 49.625	L 29 17.3188
30-0	325 42 55.14	4 55 57.76	15 07.02	55 28.901	U 30 05.7003
30-5	331 53 25.63	4 43 11.81	15 01.96	55 10.321	L 30 18.0662
31-0	337 59 43.15	4 27 20.75	14 57.53	54 54.056	U 31 06.4188
31-5	344 02 22.93	4 08 39.72	14 53.76	54 40.222	L 31 18.7608
June 1-0	350 02 01.68	-3 47 23.90	14 50.67	54 28.887	U 1 07.0947
1-5	355 59 16.89	3 23 48.49	14 48.27	54 20.074	L 1 19.4230
2-0	1 54 46.14	2 58 08.74	14 46.55	54 13.765	U 2 07.7482
2-5	7 49 06.58	2 30 40.04	14 45.50	54 09.909	L 2 20.0728
3-0	13 42 54.41	2 01 38.04	14 45.10	54 08.426	U 3 08.3992
3-5	19 36 44.47	-1 31 18.81	14 45.31	54 09.204	L 3 20.7297
4-0	25 31 09.82	0 59 58.99	14 46.10	54 12.113	U 4 09.0666
4-5	31 26 41.43	-0 27 55.94	14 47.44	54 17.002	L 4 21.4121
5-0	37 23 47.86	+0 04 32.15	14 49.26	54 23.704	U 5 09.7682
5-5	43 22 54.96	0 37 06.22	14 51.53	54 32.039	L 5 22.1369
6-0	49 24 25.68	+1 09 26.25	14 54.20	54 41.822	U 6 10.5198
6-5	55 28 39.86	1 41 11.35	14 57.21	54 52.861	L 6 22.9179
7-0	61 35 54.12	2 11 59.83	15 00.50	55 04.966	U 7 11.3317
7-5	67 46 21.75	2 41 29.44	15 04.04	55 17.950	L 7 23.7611
8-0	74 00 12.76	3 09 17.52	15 07.77	55 31.636	... ..
8-5	80 17 33.97	+3 35 01.45	15 11.65	55 45.859	U 8 12.2050
9-0	86 38 29.14	+3 58 18.93	15 15.63	56 00.470	L 9 00.6612

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
June 9.0	86° 38' 29".14	+3° 58' 18".93	15' 15".63	56' 00".470	L 9 00.6612 ^h
9.5	93 02 59.23	4 18 48.47	15 19.68	56 15.338 ^{+14.868}	U 9 13.1269 ^{12.4657}
10.0	99 31 02.81	4 36 09.84	15 23.77	56 30.351 ^{15.013}	L 10 01.5984 ^{.4715}
10.5	106 02 36.38	4 50 04.54	15 27.87	56 45.419 ^{15.068}	U 10 14.0716 ^{.4732}
11.0	112 37 34.87	5 00 16.24	15 31.97	57 00.466 ^{15.047}	L 11 02.5427 ^{.4711}
11.5	119 15 52.15	+5 06 31.25	15 36.05	57 15.433 ^{14.967}	U 11 15.0081 ^{.4654}
12.0	125 57 21.42	5 08 38.85	15 40.09	57 30.271 ^{+14.838}	L 12 03.4652 ^{12.4571}
12.5	132 41 55.68	5 06 31.65	15 44.09	57 44.937 ^{14.666}	U 12 15.9121 ^{.4469}
13.0	139 29 28.09	5 00 05.87	15 48.02	57 59.382 ^{14.445}	L 13 04.3482 ^{.4361}
13.5	146 19 52.15	4 49 21.58	15 51.88	58 13.551 ^{14.169}	U 13 16.7737 ^{.4255}
14.0	153 13 01.80	+4 34 22.81	15 55.65	58 27.372 ^{13.821}	L 14 05.1896 ^{.4159}
14.5	160 08 51.35	4 15 17.75	15 59.29	58 40.748 ^{+13.376}	U 14 17.5976 ^{12.4080}
15.0	167 07 15.25	3 52 18.78	16 02.78	58 53.555 ^{12.807}	L 15 05.9999 ^{.4023}
15.5	174 08 07.62	3 25 42.54	16 06.07	59 05.637 ^{12.082}	U 15 18.3989 ^{.3990}
16.0	181 11 21.80	2 55 49.87	16 09.12	59 16.803 ^{11.166}	L 16 06.7974 ^{.3985}
16.5	188 16 49.60	+2 23 05.75	16 11.85	59 26.831 ^{10.028}	U 16 19.1984 ^{.4010}
17.0	195 24 20.67	1 47 59.09	16 14.20	59 35.473 ^{+8.642}	L 17 07.6047 ^{12.4063}
17.5	202 33 41.71	1 11 02.41	16 16.11	59 42.463 ^{6.990}	U 17 20.0193 ^{.4146}
18.0	209 44 35.86	+0 32 51.37	16 17.49	59 47.530 ^{5.067}	L 18 08.4448 ^{.4255}
18.5	216 56 42.16	-0 05 55.91	16 18.27	59 50.411 ^{2.881}	U 18 20.8836 ^{.4388}
19.0	224 09 35.28	-0 44 39.69	16 18.40	59 50.870 ^{+0.459}	L 19 09.3374 ^{.4538}
19.5	231 22 45.44	1 22 39.62	16 17.81	59 48.715 ^{-2.155}	U 19 21.8070 ^{12.4696}
20.0	238 35 38.79	1 59 15.93	16 16.47	59 43.813 ^{4.902}	L 20 10.2922 ^{.4852}
20.5	245 47 38.03	2 33 50.63	16 14.38	59 36.109 ^{7.704}	U 20 22.7911 ^{.4989}
21.0	252 58 03.39	3 05 48.72	16 11.52	59 25.627 ^{10.482}	L 21 11.3006 ^{.5095}
21.5	260 06 13.93	-3 34 39.30	16 07.94	59 12.482 ^{13.145}	U 21 23.8161 ^{.5155}
22.0	267 11 29.04	3 59 56.50	16 03.69	58 56.875 ^{-15.607}	... ..^{12.5157}
22.5	274 13 09.97	4 21 20.05	15 58.84	58 39.087 ^{17.788}	L 22 12.3318 ^{...}
23.0	281 10 41.46	4 38 35.64	15 53.49	58 19.467 ^{19.620}	U 23 00.8420 ^{.5102}
23.5	288 03 33.05	4 51 34.88	15 47.76	57 58.415 ^{21.052}	L 23 13.3412 ^{.4992}
24.0	294 51 20.32	-5 00 14.99	15 41.75	57 36.368 ^{22.047}	U 24 01.8249 ^{.4837}
24.5	301 33 45.66	5 04 38.27	15 35.60	57 13.778 ^{-22.590}	L 24 14.2899 ^{12.4650}
25.0	308 10 38.76	5 04 51.36	15 29.42	56 51.101 ^{22.677}	U 25 02.7348 ^{.4449}
25.5	314 41 56.81	5 01 04.45	15 23.34	56 28.775 ^{22.326}	L 25 15.1591 ^{.4243}
26.0	321 07 44.28	4 53 30.46	15 17.46	56 07.214 ^{21.561}	U 26 03.5636 ^{.4045}
26.5	327 28 12.52	-4 42 24.30	15 11.90	55 46.797 ^{20.417}	L 26 15.9499 ^{.3863}
27.0	333 43 39.18	4 28 02.13	15 06.74	55 27.862 ^{-18.935}	U 27 04.3201 ^{12.3702}
27.5	339 54 27.45	4 10 40.84	15 02.07	55 10.700 ^{17.162}	L 27 16.6766 ^{.3565}
28.0	346 01 05.29	3 50 37.66	14 57.94	54 55.558 ^{15.142}	U 28 05.0218 ^{.3452}
28.5	352 04 04.60	3 28 09.75	14 54.42	54 42.635 ^{12.923}	L 28 17.3585 ^{.3367}
29.0	358 04 00.44	-3 03 34.14	14 51.55	54 32.084 ^{10.551}	U 29 05.6891 ^{.3306}
29.5	4 01 30.23	2 37 07.58	14 49.35	54 24.015 ^{-8.069}	L 29 18.0162 ^{12.3271}
30.0	9 57 13.06	2 09 06.59	14 47.84	54 18.496 ^{5.519}	U 30 06.3424 ^{.3262}
30.5	15 51 48.99	1 39 47.51	14 47.04	54 15.556 ^{2.940}	L 30 18.6702 ^{.3278}
July 1.0	21 45 58.44	1 09 26.70	14 46.94	54 15.183 ^{-0.373}	U 1 07.0020 ^{.3318}
1.5	27 40 21.55	-0 38 20.64	14 47.53	54 17.332 ^{+2.149}	L 1 19.3403 ^{.3383}
2.0	33 35 37.63	-0 06 46.17	14 48.78	54 21.919 ^{+4.587}	U 2 07.6873 ^{12.3470}

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FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi-diameter	Horizontal Parallax	Ephemeris Transit
July 1.0	21° 45' 58".44	-1° 09' 26".70	14' 46".94	54' 15".183 + 2".149	U 1 07:0020 ^d 12:3383 ^h
1.5	27 40 21.55	0 38 20.64	14 47.53	54 17.332 + 4.587	L 1 19:3403 3470
2.0	33 35 37.63	-0 06 46.17	14 48.78	54 21.919 6.911	U 2 07:6873 3580
2.5	39 32 24.60	+0 24 59.34	14 50.66	54 28.830 9.086	L 2 20:0453 3709
3.0	45 31 18.35	0 56 37.82	14 53.13	54 37.916 11.081	U 3 08:4162 3857
3.5	51 32 52.28	+1 27 50.36	14 56.15	54 48.997 + 12.868	L 3 20:8019 12:4016
4.0	57 37 36.61	1 58 17.12	14 59.66	55 01.865 14.420	U 4 09:2035 4182
4.5	63 45 57.89	2 27 37.33	15 03.59	55 16.285 15.712	L 4 21:6217 4347
5.0	69 58 18.37	2 55 29.36	15 07.87	55 31.997 16.727	U 5 10:0564 4501
5.5	76 14 55.60	3 21 30.89	15 12.43	55 48.724 17.450	L 5 22:5065 4632
6.0	82 36 01.88	+3 45 19.22	15 17.18	56 06.174 + 17.873	U 6 10:9697 12:4732
6.5	89 01 44.02	4 06 31.67	15 22.05	56 24.047 17.997	L 6 23:4429 4793
7.0	95 32 03.12	4 24 46.12	15 26.95	56 42.044 17.832	U 7 11:9222 4811
7.5	102 06 54.62	4 39 41.61	15 31.81	56 59.876 17.392	... ..
8.0	108 46 08.52	4 50 59.01	15 36.55	57 17.268 16.703	L 8 00:4033 4785
8.5	115 29 29.84	+4 58 21.79	15 41.10	57 33.971 + 15.798	U 8 12:8818 12:4722
9.0	122 16 39.36	5 01 36.65	15 45.40	57 49.769 14.711	L 9 01:3540 4629
9.5	129 07 14.48	5 00 34.18	15 49.41	58 04.480 13.485	U 9 13:8169 4518
10.0	136 00 50.32	4 55 09.39	15 53.09	58 17.965 12.160	L 10 02:2687 4400
10.5	142 57 00.84	4 45 22.05	15 56.40	58 30.125 10.777	U 10 14:7087 4283
11.0	149 55 19.99	+4 31 16.87	15 59.33	58 40.902 + 9.369	L 11 03:1370 12:4179
11.5	156 55 22.76	4 13 03.54	16 01.89	58 50.271 7.965	U 11 15:5549 4090
12.0	163 56 46.08	3 50 56.57	16 04.06	58 58.236 6.588	L 12 03:9639 4026
12.5	170 59 09.44	3 25 14.94	16 05.85	59 04.824 5.247	U 12 16:3665 3986
13.0	178 02 15.25	2 56 21.73	16 07.28	59 10.071 3.946	L 13 04:7651 3973
13.5	185 05 48.89	+2 24 43.55	16 08.36	59 14.017 + 2.680	U 13 17:1624 12:3991
14.0	192 09 38.52	1 50 50.01	16 09.09	59 16.697 1.437	L 14 05:5615 4036
14.5	199 13 34.58	1 15 13.14	16 09.48	59 18.134 + 0.201	U 14 17:9651 4111
15.0	206 17 29.09	0 38 26.75	16 09.53	59 18.335 - 1.047	L 15 06:3762 4210
15.5	213 21 14.87	+0 01 05.88	16 09.25	59 17.288 2.324	U 15 18:7972 4332
16.0	220 24 44.63	-0 36 13.88	16 08.61	59 14.964 - 3.643	L 16 07:2304 12:4470
16.5	227 27 50.14	1 12 56.97	16 07.62	59 11.321 5.013	U 16 19:6774 4617
17.0	234 30 21.40	1 48 28.54	16 06.26	59 06.308 6.436	L 17 08:1391 4761
17.5	241 32 06.09	2 22 15.12	16 04.50	58 59.872 7.904	U 17 20:6152 4889
18.0	248 32 49.17	2 53 45.29	16 02.35	58 51.968 9.397	L 18 09:1041 4988
18.5	255 32 12.77	-3 22 30.39	15 59.79	58 42.571 - 10.892	U 18 21:6029 12:5046
19.0	262 29 56.34	3 48 05.15	15 56.82	58 31.679 12.353	L 19 10:1075 5053
19.5	269 25 37.15	4 10 08.22	15 53.46	58 19.326 13.743	U 19 22:6128 5007
20.0	276 18 50.98	4 28 22.70	15 49.71	58 05.583 15.018	L 20 11:1135 4911
20.5	283 09 13.07	4 42 36.35	15 45.62	57 50.565 16.134	U 20 23:6046 4772
21.0	289 56 19.19	-4 52 41.79	15 41.23	57 34.431 - 17.050	... ..
21.5	296 39 46.78	4 58 36.40	15 36.58	57 17.381 17.730	L 21 12:0818 12:4603
22.0	303 19 16.05	5 00 22.10	15 31.75	56 59.651 18.145	U 22 00:5421 4417
22.5	309 54 30.93	4 58 04.92	15 26.81	56 41.506 18.268	L 22 12:9838 4225
23.0	316 25 19.95	4 51 54.49	15 21.83	56 23.238 18.091	U 23 01:4063 4039
23.5	322 51 36.77	-4 42 03.42	15 16.90	56 05.147 - 17.605	L 23 13:8102 12:3867
24.0	329 13 20.58	-4 28 46.67	15 12.10	55 47.542	U 24 02:1969

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
July 24.0	329 13 20.58	-4 28 46.67	15 12.10	55 47.542	U 24 02.1969 ^{d h}
24.5	335 30 36.27	4 12 20.94	15 07.52	55 30.729	L 24 14.5681 ^h
25.0	341 43 34.32	3 53 04.03	15 03.24	55 15.002	U 25 02.9260
25.5	347 52 30.60	3 31 14.41	14 59.32	55 00.638	L 25 15.2730
26.0	353 57 45.97	3 07 10.74	14 55.85	54 47.894	U 26 03.6115
26.5	359 59 45.81	-2 41 11.63	14 52.88	54 37.001	L 26 15.9440
27.0	5 58 59.55	2 13 35.40	14 50.48	54 28.162	U 27 04.2729
27.5	11 56 00.04	1 44 39.99	14 48.67	54 21.547	L 27 16.6008
28.0	17 51 22.99	1 14 42.96	14 47.52	54 17.296	U 28 04.9300
28.5	23 45 46.43	0 44 01.48	14 47.03	54 15.515	L 28 17.2629
29.0	29 39 50.05	-0 12 52.55	14 47.24	54 16.275	U 29 05.6020
29.5	35 34 14.69	+0 18 26.92	14 48.15	54 19.611	L 29 17.9495
30.0	41 29 41.70	0 49 39.91	14 49.76	54 25.522	U 30 06.3076
30.5	47 26 52.32	1 20 29.07	14 52.06	54 33.968	L 30 18.6783
31.0	53 26 27.00	1 50 36.56	14 55.03	54 44.869	U 31 07.0635
31.5	59 29 04.76	+2 19 43.84	14 58.63	54 58.101	L 31 19.4644
Aug. 1.0	65 35 22.32	2 47 31.61	15 02.83	55 13.497	U 1 07.8819
1.5	71 45 53.38	3 13 39.73	15 07.56	55 30.848	L 1 20.3159
2.0	78 01 07.63	3 37 47.25	15 12.74	55 49.893	U 2 08.7656
2.5	84 21 29.97	3 59 32.60	15 18.31	56 10.331	L 2 21.2289
3.0	90 47 19.48	+4 18 33.88	15 24.17	56 31.815	U 3 09.7031
3.5	97 18 48.68	4 34 29.29	15 30.20	56 53.960	L 3 22.1843
4.0	103 56 02.68	4 46 57.77	15 36.30	57 16.351	U 4 10.6684
4.5	110 38 58.73	4 55 39.70	15 42.35	57 38.548	L 4 23.1510
5.0	117 27 25.91	5 00 17.83	15 48.22	58 00.106	U 5 11.6284
5.5	124 21 05.18	+5 00 38.19	15 53.80	58 20.583	...
6.0	131 19 29.93	4 56 31.01	15 58.97	58 39.562	L 6 00.0975
6.5	138 22 06.83	4 47 51.57	16 03.63	58 56.663	U 6 12.5563
7.0	145 28 17.12	4 34 40.93	16 07.69	59 11.567	L 7 01.0039
7.5	152 37 18.27	4 17 06.27	16 11.08	59 24.022	U 7 13.4403
8.0	159 48 25.77	+3 55 21.07	16 13.76	59 33.856	L 8 01.8667
8.5	167 00 55.03	3 29 44.86	16 15.70	59 40.983	U 8 14.2845
9.0	174 14 03.19	3 00 42.73	16 16.91	59 45.403	L 9 02.6959
9.5	181 27 10.64	2 28 44.44	16 17.39	59 47.191	U 9 15.1035
10.0	188 39 42.22	1 54 23.50	16 17.20	59 46.492	L 10 03.5097
10.5	195 51 08.01	+1 18 16.02	16 16.39	59 43.502	U 10 15.9175
11.0	203 01 03.60	0 40 59.61	16 15.02	59 38.457	L 11 04.3296
11.5	210 09 10.09	+0 03 12.32	16 13.15	59 31.608	U 11 16.7484
12.0	217 15 13.55	-0 34 28.30	16 10.86	59 23.212	L 12 05.1764
12.5	224 19 04.41	1 11 26.01	16 08.22	59 13.516	U 12 17.6153
13.0	231 20 36.49	-1 47 06.50	16 05.29	59 02.746	L 13 06.0664
13.5	238 19 46.04	2 20 57.95	16 02.11	58 51.100	U 13 18.5300
14.0	245 16 30.81	2 52 31.35	15 58.75	58 38.746	L 14 07.0055
14.5	252 10 40.06	3 21 20.84	15 55.23	58 25.818	U 14 19.4910
15.0	259 02 38.90	3 47 03.96	15 51.58	58 12.422	L 15 07.9836
15.5	265 51 57.63	-4 09 21.75	15 47.82	57 58.637	U 15 20.4793
16.0	272 38 41.40	-4 27 58.96	15 43.98	57 44.526	L 16 08.9736

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Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Aug. 16.0	272° 38' 41".40	-4° 27' 58".96	15' 43".98	57' 44".526	L 16 08.9736 ^{d h}
16.5	279 22 45.02	4 42 44.11	15 40.05	57 30.135	U 16 21.4618 ^h
17.0	286 04 02.02	4 53 29.52	15 36.07	57 15.509	L 17 09.9397
17.5	292 42 24.90	5 00 11.32	15 32.03	57 00.693	U 17 22.4039
18.0	299 17 45.52	5 02 49.34	15 27.96	56 45.739	L 18 10.8521
18.5	305 49 55.68	-5 01 26.99	15 23.87	56 30.714	U 18 23.2830
19.0	312 18 47.69	4 56 11.02	15 19.78	56 15.703	L 19 11.6963
19.5	318 44 15.08	4 47 11.20	15 15.72	56 00.807	... ..
20.0	325 06 13.18	4 34 39.98	15 11.72	55 46.150	U 20 00.0928
20.5	331 24 39.76	4 18 52.08	15 07.83	55 31.874	L 20 12.4736
21.0	337 39 35.51	-4 00 04.00	15 04.09	55 18.142	U 21 00.8404
21.5	343 51 04.44	3 38 33.65	15 00.55	55 05.127	L 21 13.1954
22.0	349 59 14.17	3 14 39.83	14 57.25	54 53.017	U 22 01.5405
22.5	356 04 16.07	2 48 41.94	14 54.25	54 42.005	L 22 13.8781
23.0	2 06 25.35	2 20 59.54	14 51.60	54 32.289	U 23 02.2105
23.5	8 06 00.97	-1 51 52.15	14 49.36	54 24.062	L 23 14.5399
24.0	14 03 25.54	1 21 39.03	14 47.58	54 17.514	U 24 02.8686
24.5	19 59 05.09	0 50 39.06	14 46.30	54 12.823	L 24 15.1989
25.0	25 53 28.80	-0 19 10.66	14 45.57	54 10.155	U 25 03.5329
25.5	31 47 08.71	+0 12 28.17	14 45.44	54 09.657	L 25 15.8729
26.0	37 40 39.36	+0 43 59.80	14 45.93	54 11.457	U 26 04.2210
26.5	43 34 37.38	1 15 06.85	14 47.07	54 15.657	L 26 16.5792
27.0	49 29 41.05	1 45 32.08	14 48.89	54 22.331	U 27 04.9493
27.5	55 26 29.84	2 14 58.16	14 51.39	54 31.523	L 27 17.3330
28.0	61 25 43.80	2 43 07.56	14 54.58	54 43.238	U 28 05.7313
28.5	67 28 03.01	+3 09 42.34	14 58.45	54 57.442	L 28 18.1452
29.0	73 34 06.78	3 34 24.09	15 02.98	55 14.056	U 29 06.5744
29.5	79 44 32.84	3 56 53.82	15 08.13	55 32.949	L 29 19.0183
30.0	85 59 56.42	4 16 52.01	15 13.85	55 53.935	U 30 07.4753
30.5	92 20 49.22	4 33 58.70	15 20.07	56 16.766	L 30 19.9426
31.0	98 47 38.27	+4 47 53.81	15 26.70	56 41.133	U 31 08.4172
Sept. 31.5	105 20 44.73	4 58 17.56	15 33.66	57 06.658	L 31 20.8953
1.0	112 00 22.71	5 04 51.04	15 40.81	57 32.904	U 1 09.3732
1.5	118 46 38.17	5 07 17.01	15 48.02	57 59.369	L 1 21.8475
2.0	125 39 27.91	5 05 20.89	15 55.14	58 25.504	U 2 10.3155
2.5	132 38 39.00	+4 58 51.76	16 02.01	58 50.726	L 2 22.7752
3.0	139 43 48.41	4 47 43.51	16 08.47	59 14.434	U 3 11.2259
3.5	146 54 23.32	4 31 55.87	16 14.36	59 36.037	L 3 23.6675
4.0	154 09 41.88	4 11 35.28	16 19.52	59 54.982	... ..
4.5	161 28 54.53	3 46 55.46	16 23.82	60 10.781	U 4 12.1009
5.0	168 51 05.89	+3 18 17.50	16 27.16	60 23.041	L 5 00.5276
5.5	176 15 16.96	2 46 09.60	16 29.46	60 31.489	U 5 12.9495
6.0	183 40 27.54	2 11 06.19	16 30.69	60 35.982	L 6 01.3689
6.5	191 05 38.69	1 33 46.70	16 30.83	60 36.519	U 6 13.7885
7.0	198 29 54.86	0 54 53.98	16 29.94	60 33.231	L 7 02.2108
7.5	205 52 25.77	+0 15 12.63	16 28.07	60 26.373	U 7 14.6382
8.0	213 12 27.72	-0 24 32.76	16 25.33	60 16.298	L 8 03.0731

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Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Sept. 8.0	213 12 27.72	-0 24 32.76	16 25.33	60 16.298	L 8 03.0731 ^{d h}
8.5	220 29 24.39	1 03 39.13	16 21.82	60 03.431	U 8 15.5175 ^h
9.0	227 42 47.12	1 41 26.24	16 17.68	59 48.240	L 9 03.9725
9.5	234 52 14.73	2 17 17.62	16 13.04	59 31.210	U 9 16.4389
10.0	241 57 32.94	2 50 41.22	16 08.03	59 12.813	L 10 04.9160
10.5	248 58 33.65	-3 21 09.69	16 02.77	58 53.494	U 10 17.4026
11.0	255 55 13.86	3 48 20.48	15 57.36	58 33.654	L 11 05.8960
11.5	262 47 34.73	4 11 55.69	15 51.91	58 13.639	U 11 18.3926
12.0	269 35 40.55	4 31 41.87	15 46.49	57 53.740	L 12 06.8882
12.5	276 19 37.80	4 47 29.65	15 41.16	57 34.187	U 12 19.3784
13.0	282 59 34.37	-4 59 13.45	15 35.97	57 15.160	L 13 07.8592
13.5	289 35 38.87	5 06 51.17	15 30.97	56 56.786	U 13 20.3270
14.0	296 08 00.11	5 10 23.84	15 26.17	56 39.155	L 14 08.7795
14.5	302 36 46.77	5 09 55.38	15 21.58	56 22.321	U 14 21.2151
15.0	309 02 07.17	5 05 32.34	15 17.22	56 06.315	L 15 09.6334
15.5	315 24 09.20	-4 57 23.69	15 13.09	55 51.150	U 15 22.0348
16.0	321 43 00.39	4 45 40.53	15 09.19	55 36.830	L 16 10.4205
16.5	327 58 48.02	4 30 35.97	15 05.52	55 23.360	U 16 22.7918
17.0	334 11 39.36	4 12 24.81	15 02.08	55 10.743	L 17 11.1507
17.5	340 21 41.93	3 51 23.34	14 58.88	54 58.996	U 17 23.4992
18.0	346 29 03.81	-3 27 49.10	14 55.92	54 48.146	L 18 11.8395
18.5	352 33 53.98	3 02 00.60	14 53.22	54 38.233	... ..
19.0	358 36 22.59	2 34 17.09	14 50.79	54 29.317	U 19 00.1736
19.5	4 36 41.29	2 04 58.24	14 48.65	54 21.471	L 19 12.5037
20.0	10 35 03.45	1 34 24.01	14 46.83	54 14.788	U 20 00.8320
20.5	16 31 44.43	-1 02 54.35	14 45.36	54 09.370	L 20 13.1606
21.0	22 27 01.69	-0 30 49.05	14 44.26	54 05.336	U 21 01.4916
21.5	28 21 14.95	+0 01 32.36	14 43.57	54 02.810	L 21 13.8270
22.0	34 14 46.23	0 33 50.74	14 43.33	54 01.923	U 22 02.1688
22.5	40 07 59.88	1 05 47.40	14 43.57	54 02.808	L 22 14.5188
23.0	46 01 22.55	+1 37 04.06	14 44.33	54 05.595	U 23 02.8788
23.5	51 55 23.03	2 07 22.86	14 45.64	54 10.409	L 23 15.2502
24.0	57 50 32.18	2 36 26.28	14 47.53	54 17.361	U 24 03.6344
24.5	63 47 22.61	3 03 57.07	14 50.04	54 26.548	L 24 16.0321
25.0	69 46 28.45	3 29 38.09	14 53.17	54 38.041	U 25 04.4437
25.5	75 48 24.91	+3 53 12.27	14 56.94	54 51.885	L 25 16.8688
26.0	81 53 47.84	4 14 22.48	15 01.35	55 08.090	U 26 05.3066
26.5	88 03 13.09	4 32 51.53	15 06.40	55 26.625	L 26 17.7552
27.0	94 17 15.81	4 48 22.14	15 12.07	55 47.405	U 27 06.2123
27.5	100 36 29.60	5 00 37.07	15 18.30	56 10.294	L 27 18.6750
28.0	107 01 25.50	+5 09 19.37	15 25.06	56 35.085	U 28 07.1403
28.5	113 32 30.91	5 14 12.68	15 32.25	57 01.502	L 28 19.6050
29.0	120 10 08.32	5 15 01.82	15 39.80	57 29.191	U 29 08.0667
29.5	126 54 34.03	5 11 33.43	15 47.57	57 57.715	L 29 20.5231
30.0	133 45 56.82	5 03 36.87	15 55.43	58 26.557	U 30 08.9730
30.5	140 44 16.76	+4 51 05.20	16 03.21	58 55.127	L 30 21.4159
Oct. 1.0	147 49 24.12	+4 33 56.30	16 10.74	59 22.770	U 1 09.8521

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Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Oct. 1-0	147° 49' 24".12	+4° 33' 56".30	16' 10".74	59' 22".770	U 1 09.8521 ^{d h}
1-5	155 00 58.64	4 12 13.96	16 17.83	59 48.790 +26.020	L 1 22.2826 ^h 12.4305
2-0	162 18 29.29	3 46 08.84	16 24.28	60 12.477 23.687	U 2 10.7089 .4263
2-5	169 41 14.47	3 15 59.18	16 29.91	60 33.137 20.660	L 2 23.1331 .4242
3-0	177 08 22.88	2 42 11.09	16 34.54	60 50.139 17.002	U 3 11.5576 .4245
3-5	184 38 54.98	+2 05 18.29	16 38.03	61 02.945 12.806	L 3 23.9848 .4272
4-0	192 11 45.08	1 26 01.28	16 40.27	61 11.157 + 8.212	... ... 12.4325
4-5	199 45 43.75	0 45 05.95	16 41.19	61 14.539 + 3.382	U 4 12.4173 ...
5-0	207 19 40.53	+0 03 21.65	16 40.78	61 13.037 - 1.502	L 5 00.8576 .4403
5-5	214 52 26.64	-0 38 20.93	16 39.08	61 06.780 6.257	U 5 13.3078 .4502
6-0	222 22 57.51	-1 19 12.00	16 36.16	60 56.068 10.712	L 6 01.7695 .4617
6-5	229 50 14.90	1 58 24.75	16 32.15	60 41.348 -14.720	U 6 14.2439 12.4744
7-0	237 13 28.54	2 35 17.03	16 27.20	60 23.175 18.173	L 7 02.7306 .4867
7-5	244 31 57.15	3 09 12.56	16 21.48	60 02.178 20.997	U 7 15.2285 .4979
8-0	251 45 08.98	3 39 41.63	16 15.17	59 39.015 23.163	L 8 03.7351 .5066
8-5	258 52 41.68	-4 06 21.28	16 08.44	59 14.340 24.675	U 8 16.2465 .5114
9-0	265 54 21.88	4 28 55.10	16 01.48	58 48.773 -25.567	L 9 04.7582 12.5117
9-5	272 50 04.33	4 47 12.67	15 54.42	58 22.879 25.894	U 9 17.2651 .5069
10-0	279 39 50.94	5 01 08.92	15 47.41	57 57.151 25.728	L 10 05.7624 .4973
10-5	286 23 49.59	5 10 43.33	15 40.56	57 32.007 25.144	U 10 18.2461 .4837
11-0	293 02 13.02	-5 15 59.17	15 33.97	57 07.784 24.223	L 11 06.7131 .4670
11-5	299 35 17.66	5 17 02.81	15 27.69	56 44.746 -23.038	U 11 19.1617 12.4486
12-0	306 03 22.66	5 14 03.12	15 21.79	56 23.084 21.662	L 12 07.5912 .4295
12-5	312 26 48.91	5 07 10.96	15 16.30	56 02.929 20.155	U 12 20.0019 .4107
13-0	318 45 58.34	4 56 38.80	15 11.24	55 44.359 18.570	L 13 08.3951 .3932
13-5	325 01 13.22	-4 42 40.43	15 06.62	55 27.407 16.952	U 13 20.7723 .3772
14-0	331 12 55.70	4 25 30.73	15 02.44	55 12.074 -15.333	L 14 09.1355 12.3632
14-5	337 21 27.46	4 05 25.50	14 58.70	54 58.334 13.740	U 14 21.4870 .3515
15-0	343 27 09.40	3 42 41.40	14 55.38	54 46.142 12.192	L 15 09.8290 .3420
15-5	349 30 21.58	3 17 35.79	14 52.46	54 35.444 10.608	U 15 22.1638 .3348
16-0	355 31 23.06	-2 50 26.66	14 49.94	54 26.182 9.262	L 16 10.4937 .3299
16-5	1 30 32.04	2 21 32.60	14 47.79	54 18.301 - 7.881	U 16 22.8208 12.3271
17-0	7 28 05.90	1 51 12.64	14 46.01	54 11.749 6.552	L 17 11.1474 .3266
17-5	13 24 21.38	1 19 46.21	14 44.57	54 06.490 5.259	U 17 23.4755 .3281
18-0	19 19 34.78	0 47 32.99	14 43.48	54 02.499 3.991	L 18 11.8072 .3317
18-5	25 14 02.16	-0 14 52.80	14 42.74	53 59.768 2.731	... ... .3372
19-0	31 07 59.62	+0 17 54.53	14 42.34	53 58.306 - 1.462	U 19 00.1444 ...
19-5	37 01 43.54	0 50 29.27	14 42.30	53 58.142 - 0.164	L 19 12.4890 12.3446
20-0	42 55 30.83	1 22 31.92	14 42.62	53 59.318 + 1.176	U 20 00.8425 .3535
20-5	48 49 39.16	1 53 43.33	14 43.32	54 01.896 2.578	L 20 13.2066 .3641
21-0	54 44 27.20	+2 23 44.74	14 44.42	54 05.948 4.052	U 21 01.5825 .3759
21-5	60 40 14.78	2 52 17.92	14 45.95	54 11.557 + 5.609	L 21 13.9708 12.3883
22-0	66 37 23.01	3 19 05.15	14 47.93	54 18.813 7.256	U 22 02.3721 .4013
22-5	72 36 14.40	3 43 49.31	14 50.38	54 27.808 8.995	L 22 14.7860 .4139
23-0	78 37 12.83	4 06 13.81	14 53.33	54 38.629 10.821	U 23 03.2118 .4258
23-5	84 40 43.58	+4 26 02.68	14 56.79	54 51.352 12.723	L 23 15.6479 .4361
24-0	90 47 13.09	+4 43 00.50	15 00.80	55 06.037 +14.685	U 24 04.0922 12.4443

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Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Oct. 24.0	90° 47' 13".09	+4 43' 00".50	15 00".80	55 06".037 +16.683	U 24 04.0922 ^d 12.4500 ^h
24.5	96 57 08.79	4 56 52.43	15 05.34	55 22.720 18.686	L 24 16.5422 .4527
25.0	103 10 58.72	5 07 24.30	15 10.43	55 41.406 20.649	U 25 04.9949 .4527
25.5	109 29 11.06	5 14 22.68	15 16.06	56 02.055 22.528	L 25 17.4476 .4501
26.0	115 52 13.53	5 17 35.09	15 22.20	56 24.583 24.258	U 26 05.8977 .4455
26.5	122 20 32.65	+5 16 50.23	15 28.80	56 48.841 +25.777	L 26 18.3432 12.4396
27.0	128 54 32.86	5 11 58.43	15 35.83	57 14.618 27.004	U 27 06.7828 .4329
27.5	135 34 35.46	5 02 52.15	15 43.18	57 41.622 27.857	L 27 19.2157 .4264
28.0	142 20 57.49	4 49 26.60	15 50.77	58 09.479 28.254	U 28 07.6421 .4207
28.5	149 13 50.43	4 31 40.55	15 58.47	58 37.733 28.105	L 28 20.0628 .4164
29.0	156 13 18.98	+4 09 37.16	16 06.13	59 05.838 +27.338	U 29 08.4792 12.4139
29.5	163 19 19.76	3 43 24.91	16 13.58	59 33.176 25.890	L 29 20.8931 .4139
30.0	170 31 40.22	3 13 18.36	16 20.63	59 59.066 23.724	U 30 09.3070 .4163
30.5	177 49 57.77	2 39 38.92	16 27.09	60 22.790 20.833	L 30 21.7233 .4215
31.0	185 13 39.30	2 02 55.09	16 32.77	60 43.623 17.254	U 31 10.1448 .4295
Nov. 31.5	192 42 01.19	+1 23 42.46	16 37.47	61 00.877 +13.062	L 31 22.5743 12.4401
1.0	200 14 09.94	0 42 43.04	16 41.03	61 13.939 8.377	U 1 11.0144 .4534
1.5	207 49 03.37	+0 00 44.08	16 43.31	61 22.316 +3.361	L 1 23.4678 .4683
2.0	215 25 32.53	-0 41 23.67	16 44.23	61 25.677 -1.804	U 2 11.9361 .4844
2.5	223 02 24.12	1 22 48.17	16 43.74	61 23.873 6.916	... ..
3.0	230 38 23.24	-2 02 38.39	16 41.85	61 16.957 -11.781	L 3 00.4205 12.5003
3.5	238 12 16.38	2 40 06.68	16 38.64	61 05.176 16.224	U 3 12.9208 .5145
4.0	245 42 54.29	3 14 30.79	16 34.22	60 48.952 20.100	L 4 01.4353 .5255
4.5	253 09 14.51	3 45 15.40	16 28.75	60 28.852 23.310	U 4 13.9608 .5315
5.0	260 30 23.50	4 11 53.02	16 22.39	60 05.542 25.796	L 5 02.4923 .5319
5.5	267 45 38.02	-4 34 04.33	16 15.37	59 39.746 -27.541	U 5 15.0242 12.5257
6.0	274 54 25.93	4 51 37.82	16 07.86	59 12.205 28.571	L 6 03.5499 .5139
6.5	281 56 26.26	5 04 29.14	16 00.08	58 43.634 28.933	U 6 16.0638 .4972
7.0	288 51 28.83	5 12 40.05	15 52.20	58 14.701 28.699	L 7 04.5610 .4772
7.5	295 39 33.29	5 16 17.33	15 44.38	57 46.002 27.950	U 7 17.0382 .4555
8.0	302 20 48.02	-5 15 31.62	15 36.76	57 18.052 -26.774	L 8 05.4937 12.4335
8.5	308 55 28.73	5 10 36.44	15 29.47	56 51.278 25.254	U 8 17.9272 .4124
9.0	315 23 57.09	5 01 47.25	15 22.59	56 26.024 23.474	L 9 06.3396 .3929
9.5	321 46 39.37	4 49 20.82	15 16.19	56 02.550 21.505	U 9 18.7325 .3758
10.0	328 04 05.13	4 33 34.66	15 10.33	55 41.045 19.415	L 10 07.1083 .3609
10.5	334 16 46.14	-4 14 46.64	15 05.04	55 21.630 -17.261	U 10 19.4692 12.3487
11.0	340 25 15.35	3 53 14.82	15 00.34	55 04.369 15.089	L 11 07.8179 .3391
11.5	346 30 06.08	3 29 17.27	14 56.23	54 49.280 12.940	U 11 20.1570 .3321
12.0	352 31 51.33	3 03 12.08	14 52.70	54 36.340 10.843	L 12 08.4891 .3276
12.5	358 31 03.25	2 35 17.31	14 49.75	54 25.497 8.823	U 12 20.8167 .3254
13.0	4 28 12.67	-2 05 51.11	14 47.35	54 16.674 -6.897	L 13 09.1421 12.3257
13.5	10 23 48.80	1 35 11.74	14 45.47	54 09.777 5.075	U 13 21.4678 .3281
14.0	16 18 19.02	1 03 37.61	14 44.09	54 04.702 3.363	L 14 09.7959 .3327
14.5	22 12 08.78	-0 31 27.38	14 43.17	54 01.339 1.761	U 14 22.1286 .3393
15.0	28 05 41.46	+0 01 00.09	14 42.69	53 59.578 -0.262	L 15 10.4679 .3478
15.5	33 59 18.48	+0 33 25.69	14 42.62	53 59.316 +1.140	U 15 22.8157 12.3579
16.0	39 53 19.32	+1 05 30.17	14 42.93	54 00.456	L 16 11.1736

MOON, 1967
FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Nov. 16.0	39° 53' 19.32	+1° 05' 30.17	14' 42.93	54' 00.456 + 2.460	L 16 11.1736 ^{d h} 12.3695 ^h
16.5	45 48 01.67	1 36 54.19	14 43.60	54 02.916	U 16 23.5431 3821
17.0	51 43 41.61	2 07 18.45	14 44.61	54 06.626 3.710	L 17 11.9252 3952
17.5	57 40 33.86	2 36 23.80	14 45.95	54 11.535 4.909	...
18.0	63 38 52.03	3 03 51.44	14 47.60	54 17.609 6.074	U 18 00.3204 ...
18.5	69 38 48.93	+3 29 23.04	14 49.57	54 24.834 7.225	L 18 12.7287 4083
19.0	75 40 36.86	3 52 40.96	14 51.85	54 33.211 + 8.377	U 19 01.1494 12.4207
19.5	81 44 27.97	4 13 28.38	14 54.45	54 42.760 9.549	L 19 13.5811 4317
20.0	87 50 34.53	4 31 29.49	14 57.38	54 53.511 10.751	U 20 02.0217 4406
20.5	93 59 09.23	4 46 29.65	15 00.65	55 05.505 11.994	L 20 14.4684 4467
21.0	100 10 25.44	+4 58 15.46	15 04.27	55 18.785 13.280	U 21 02.9182 4498
21.5	106 24 37.38	5 06 34.98	15 08.25	55 33.392 +14.607	L 21 15.3680 12.4498
22.0	112 42 00.20	5 11 17.76	15 12.60	55 49.357 15.965	U 22 03.8148 4468
22.5	119 02 50.00	5 12 15.07	15 17.32	56 06.695 17.338	L 22 16.2563 4415
23.0	125 27 23.71	5 09 20.00	15 22.42	56 25.395 18.700	U 23 04.6907 4344
23.5	131 55 58.84	+5 02 27.66	15 27.87	56 45.412 20.017	L 23 17.1170 4263
24.0	138 28 53.14	4 51 35.47	15 33.66	57 06.656 +21.244	U 24 05.5352 12.4182
24.5	145 06 23.97	4 36 43.43	15 39.74	57 28.987 22.331	L 24 17.9457 4105
25.0	151 48 47.69	4 17 54.53	15 46.07	57 52.202 23.215	U 25 06.3499 4042
25.5	158 36 18.70	3 55 15.16	15 52.56	58 16.030 23.828	L 25 18.7495 3996
26.0	165 29 08.43	+3 28 55.60	15 59.12	58 40.127 24.097	U 26 07.1466 3971
26.5	172 27 24.21	2 59 10.55	16 05.65	59 04.074 +23.947	L 26 19.5439 12.3973
27.0	179 31 07.97	2 26 19.56	16 12.00	59 27.382 23.308	U 27 07.9441 4002
27.5	186 40 15.01	1 50 47.42	16 18.02	59 49.500 22.118	L 27 20.3502 4061
28.0	193 54 32.77	1 13 04.34	16 23.56	60 09.834 20.334	U 28 08.7652 4150
28.5	201 13 39.84	+0 33 45.82	16 28.45	60 27.766 17.932	L 28 21.1923 4271
29.0	208 37 05.23	-0 06 27.80	16 32.52	60 42.690 +14.924	U 29 09.6342 12.4419
29.5	216 04 08.15	0 46 52.25	16 35.61	60 54.042 11.352	L 29 22.0933 4591
30.0	223 33 58.32	1 26 40.67	16 37.60	61 01.342 7.300	U 30 10.5713 4780
30.5	231 05 37.02	2 05 05.35	16 38.38	61 04.228 + 2.886	L 30 23.0684 4971
Dec. 1.0	238 37 58.72	-2 41 19.69	16 37.91	61 02.487 - 1.741	U 1 11.5836 5152
1.5	246 09 53.41	3 14 40.27	16 36.16	60 56.072 - 6.415	...
2.0	253 40 09.36	3 44 28.79	16 33.18	60 45.114 10.958	L 2 00.1138 ...
2.5	261 07 36.15	4 10 13.65	16 29.03	60 29.910 15.204	U 2 12.6541 5403
3.0	268 31 07.68	4 31 31.04	16 23.86	60 10.905 19.005	L 3 01.1981 5440
3.5	275 49 44.88	-4 48 05.41	16 17.80	59 48.663 22.242	U 3 13.7385 5404
4.0	283 02 37.92	4 59 49.34	16 11.03	59 23.827 -24.836	L 4 02.2682 12.5297
4.5	290 09 07.75	5 06 42.96	16 03.74	58 57.084 26.743	U 4 14.7814 5132
5.0	297 08 46.92	5 08 52.90	15 56.13	58 29.129 27.955	L 5 03.2737 4923
5.5	304 01 19.68	5 06 31.06	15 48.36	58 00.629 28.500	U 5 15.7428 4691
6.0	310 46 41.49	-4 59 53.40	15 40.62	57 32.208 28.421	L 6 04.1880 4452
6.5	317 24 58.05	4 49 18.63	15 33.05	57 04.422 -27.786	U 6 16.6101 12.4221
7.0	323 56 24.11	4 35 07.19	15 25.78	56 37.754 26.668	L 7 05.0110 4009
7.5	330 21 21.99	4 17 40.35	15 18.93	56 12.608 25.146	U 7 17.3928 3818
8.0	336 40 20.12	3 57 19.57	15 12.59	55 49.312 23.296	L 8 05.7585 3657
8.5	342 53 51.63	-3 34 26.03	15 06.81	55 28.118 21.194	U 8 18.1107 3522
9.0	349 02 33.04	-3 09 20.38	15 01.66	55 09.210 -18.908	L 9 06.4525 12.3418

FOR 0^h AND 12^h EPHEMERIS TIME

Date	Apparent Longitude	Apparent Latitude	Semi- diameter	Horizontal Parallax	Ephemeris Transit
Dec. 9-0	349 02 33.04	-3 09 20.38	15 01.66	55 09.210	L 9 06.4525 ^d
9-5	355 07 03.08	2 42 22.57	14 57.16	54 52.708	U 9 18.7866 ^h
10-0	1 08 01.67	2 13 51.89	14 53.34	54 38.679	L 10 07.1157
10-5	7 06 09.02	1 44 07.00	14 50.20	54 27.141	U 10 19.4425
11-0	13 02 04.87	1 13 26.08	14 47.73	54 18.070	L 11 07.7694
11-5	18 56 27.90	-0 42 06.95	14 45.91	54 11.407	U 11 20.0989
12-0	24 49 55.17	-0 10 27.30	14 44.73	54 07.064	L 12 08.4334
12-5	30 43 01.69	+0 21 15.25	14 44.15	54 04.928	U 12 20.7749
13-0	36 36 20.04	0 52 42.94	14 44.13	54 04.866	L 13 09.1256
13-5	42 30 20.09	1 23 37.85	14 44.64	54 06.734	U 13 21.4872
14-0	48 25 28.75	+1 53 41.83	14 45.63	54 10.372	L 14 09.8612
14-5	54 22 09.82	2 22 36.50	14 47.06	54 15.619	U 14 22.2487
15-0	60 20 43.81	2 50 03.39	14 48.88	54 22.311	L 15 10.6502
15-5	66 21 28.02	3 15 44.00	14 51.06	54 30.286	U 15 23.0656
16-0	72 24 36.45	3 39 20.03	14 53.54	54 39.388	L 16 11.4939
16-5	78 30 20.03	+4 00 33.63	14 56.28	54 49.475	U 16 23.9334
17-0	84 38 46.81	4 19 07.65	14 59.26	55 00.416	... ..
17-5	90 50 02.22	4 34 45.99	15 02.45	55 12.099	L 17 12.3814
18-0	97 04 09.55	4 47 13.92	15 05.81	55 24.430	U 18 00.8349
18-5	103 21 10.33	4 56 18.40	15 09.32	55 37.334	L 18 13.2903
19-0	109 41 04.93	+5 01 48.41	15 12.98	55 50.757	U 19 01.7441
19-5	116 03 53.09	5 03 35.20	15 16.77	56 04.661	L 19 14.1931
20-0	122 29 34.47	5 01 32.58	15 20.68	56 19.023	U 20 02.6348
20-5	128 58 09.17	4 55 37.08	15 24.71	56 33.829	L 20 15.0673
21-0	135 29 38.19	4 45 48.14	15 28.87	56 49.071	U 21 03.4900
21-5	142 04 03.73	+4 32 08.21	15 33.13	57 04.736	L 21 15.9028
22-0	148 41 29.43	4 14 42.87	15 37.51	57 20.803	U 22 04.3064
22-5	155 22 00.37	3 53 40.87	15 41.99	57 37.229	L 22 16.7024
23-0	162 05 42.86	3 29 14.24	15 46.54	57 53.946	U 23 05.0927
23-5	168 52 44.13	3 01 38.35	15 51.15	58 10.851	L 23 17.4795
24-0	175 43 11.68	+2 31 11.91	15 55.76	58 27.797	U 24 05.8656
24-5	182 37 12.49	1 58 17.12	16 00.34	58 44.589	L 24 18.2538
25-0	189 34 52.07	1 23 19.59	16 04.81	59 00.982	U 25 06.6470
25-5	196 36 13.29	0 46 48.35	16 09.08	59 16.680	L 25 19.0486
26-0	203 41 15.17	+0 09 15.68	16 13.08	59 31.342	U 26 07.4614
26-5	210 49 51.63	-0 28 43.20	16 16.69	59 44.588	L 26 19.8885
27-0	218 01 50.33	1 06 30.62	16 19.80	59 56.015	U 27 08.3325
27-5	225 16 51.71	1 43 27.22	16 22.31	60 05.214	L 27 20.7953
28-0	232 34 28.33	2 18 52.88	16 24.10	60 11.792	U 28 09.2778
28-5	239 54 04.70	2 52 07.97	16 25.08	60 15.397	L 28 21.7796
29-0	247 14 57.62	-3 22 34.71	16 25.17	60 15.746	U 29 10.2984
29-5	254 36 17.14	3 49 38.61	16 24.33	60 12.642	L 29 22.8301
30-0	261 57 08.10	4 12 49.86	16 22.52	60 05.999	U 30 11.3689
30-5	269 16 32.20	4 31 44.54	16 19.75	59 55.847	L 30 23.9078
31-0	276 33 30.46	4 46 05.54	16 16.07	59 42.342	... ..
31-5	283 47 05.79	-4 55 42.94	16 11.55	59 25.754	U 31 12.4395
32-0	290 56 25.56	-5 00 34.15	16 06.30	59 06.458	L 32 00.9577

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 1			January 3		
0	10 36 53.527 ^{134.198}	+13 52 12.60 ^{-863.06}	0	12 20 15.881 ^{125.855}	+1 24 32.88 ^{-973.40}
1	10 39 07.725 ^{133.922}	13 37 49.54 ^{867.55}	1	12 22 21.736 ^{125.801}	1 08 19.48 ^{973.52}
2	10 41 21.647 ^{133.651}	13 23 21.99 ^{871.95}	2	12 24 27.537 ^{125.754}	0 52 05.96 ^{973.55}
3	10 43 35.298 ^{133.383}	13 08 50.04 ^{876.24}	3	12 26 33.291 ^{125.712}	0 35 52.41 ^{973.51}
4	10 45 48.681 ^{133.118}	12 54 13.80 ^{880.44}	4	12 28 39.003 ^{125.675}	0 19 38.90 ^{973.37}
5	10 48 01.799 ^{132.857}	12 39 33.36 ^{884.54}	5	12 30 44.678 ^{125.642}	+ 0 03 25.53 ^{973.15}
6	10 50 14.656 ^{132.600}	12 24 48.82 ^{888.55}	6	12 32 50.320 ^{125.617}	- 0 12 47.62 ^{972.85}
7	10 52 27.256 ^{132.346}	12 10 00.27 ^{892.46}	7	12 34 55.937 ^{125.594}	0 29 00.47 ^{972.47}
8	10 54 39.602 ^{132.097}	11 55 07.81 ^{896.28}	8	12 37 01.531 ^{125.579}	0 45 12.94 ^{971.99}
9	10 56 51.699 ^{131.850}	11 40 11.53 ^{899.99}	9	12 39 07.110 ^{125.568}	1 01 24.93 ^{971.44}
10	10 59 03.549 ^{131.609}	11 25 11.54 ^{903.62}	10	12 41 12.678 ^{125.562}	1 17 36.37 ^{970.81}
11	11 01 15.158 ^{131.371}	11 10 07.92 ^{907.15}	11	12 43 18.240 ^{125.562}	1 33 47.18 ^{970.08}
12	11 03 26.529 ^{131.137}	10 55 00.77 ^{910.58}	12	12 45 23.802 ^{125.566}	1 49 57.26 ^{969.28}
13	11 05 37.666 ^{130.908}	10 39 50.19 ^{913.92}	13	12 47 29.368 ^{125.577}	2 06 06.54 ^{968.40}
14	11 07 48.574 ^{130.682}	10 24 36.27 ^{917.16}	14	12 49 34.945 ^{125.591}	2 22 14.94 ^{967.42}
15	11 09 59.256 ^{130.462}	10 09 19.11 ^{920.32}	15	12 51 40.536 ^{125.613}	2 38 22.36 ^{966.37}
16	11 12 09.718 ^{130.244}	9 53 58.79 ^{923.37}	16	12 53 46.149 ^{125.637}	2 54 28.73 ^{965.24}
17	11 14 19.962 ^{130.033}	9 38 35.42 ^{926.33}	17	12 55 51.786 ^{125.669}	3 10 33.97 ^{964.02}
18	11 16 29.995 ^{129.825}	9 23 09.09 ^{929.21}	18	12 57 57.455 ^{125.704}	3 26 37.99 ^{962.71}
19	11 18 39.820 ^{129.621}	9 07 39.88 ^{931.98}	19	13 00 03.159 ^{125.745}	3 42 40.70 ^{961.34}
20	11 20 49.441 ^{129.423}	8 52 07.90 ^{934.67}	20	13 02 08.904 ^{125.792}	3 58 42.04 ^{959.86}
21	11 22 58.864 ^{129.229}	8 36 33.23 ^{937.26}	21	13 04 14.696 ^{125.842}	4 14 41.90 ^{958.32}
22	11 25 08.093 ^{129.039}	8 20 55.97 ^{939.76}	22	13 06 20.538 ^{125.899}	4 30 40.22 ^{956.69}
23	11 27 17.132 ^{128.854}	+ 8 05 16.21 ^{-942.17}	23	13 08 26.437 ^{125.960}	- 4 46 36.91 ^{-954.98}
January 2			January 4		
0	11 29 25.986 ^{128.675}	+ 7 49 34.04 ^{-944.48}	0	13 10 32.397 ^{126.026}	- 5 02 31.89 ^{-953.17}
1	11 31 34.661 ^{128.499}	7 33 49.56 ^{946.72}	1	13 12 38.423 ^{126.097}	5 18 25.06 ^{951.31}
2	11 33 43.160 ^{128.329}	7 18 02.84 ^{948.84}	2	13 14 44.520 ^{126.174}	5 34 16.37 ^{949.34}
3	11 35 51.489 ^{128.164}	7 02 14.00 ^{950.89}	3	13 16 50.694 ^{126.255}	5 50 05.71 ^{947.30}
4	11 37 59.653 ^{128.002}	6 46 23.11 ^{952.85}	4	13 18 56.949 ^{126.341}	6 05 53.01 ^{945.17}
5	11 40 07.655 ^{127.847}	6 30 30.26 ^{954.71}	5	13 21 03.290 ^{126.432}	6 21 38.18 ^{942.97}
6	11 42 15.502 ^{127.697}	6 14 35.55 ^{956.49}	6	13 23 09.722 ^{126.528}	6 37 21.15 ^{940.68}
7	11 44 23.199 ^{127.550}	5 58 39.06 ^{958.17}	7	13 25 16.250 ^{126.628}	6 53 01.83 ^{938.31}
8	11 46 30.749 ^{127.410}	5 42 40.89 ^{959.76}	8	13 27 22.878 ^{126.734}	7 08 40.14 ^{935.85}
9	11 48 38.159 ^{127.274}	5 26 41.13 ^{961.28}	9	13 29 29.612 ^{126.844}	7 24 15.99 ^{933.33}
10	11 50 45.433 ^{127.143}	5 10 39.85 ^{962.69}	10	13 31 36.456 ^{126.958}	7 39 49.32 ^{930.70}
11	11 52 52.576 ^{127.017}	4 54 37.16 ^{964.02}	11	13 33 43.414 ^{127.079}	7 55 20.02 ^{928.01}
12	11 54 59.593 ^{126.898}	4 38 33.14 ^{965.27}	12	13 35 50.493 ^{127.202}	8 10 48.03 ^{925.22}
13	11 57 06.491 ^{126.781}	4 22 27.87 ^{966.42}	13	13 37 57.695 ^{127.331}	8 26 13.25 ^{922.36}
14	11 59 13.272 ^{126.672}	4 06 21.45 ^{967.49}	14	13 40 05.026 ^{127.464}	8 41 35.61 ^{919.42}
15	12 01 19.944 ^{126.566}	3 50 13.96 ^{968.46}	15	13 42 12.490 ^{127.602}	8 56 55.03 ^{916.39}
16	12 03 26.510 ^{126.467}	3 34 05.50 ^{969.36}	16	13 44 20.092 ^{127.745}	9 12 11.42 ^{913.28}
17	12 05 32.977 ^{126.371}	3 17 56.14 ^{970.17}	17	13 46 27.837 ^{127.890}	9 27 24.70 ^{910.08}
18	12 07 39.348 ^{126.282}	3 01 45.97 ^{970.88}	18	13 48 35.727 ^{128.042}	9 42 34.78 ^{906.82}
19	12 09 45.630 ^{126.198}	2 45 35.09 ^{971.52}	19	13 50 43.769 ^{128.198}	9 57 41.60 ^{903.45}
20	12 11 51.828 ^{126.119}	2 29 23.57 ^{972.07}	20	13 52 51.967 ^{128.356}	10 12 45.05 ^{900.02}
21	12 13 57.947 ^{126.045}	2 13 11.50 ^{972.53}	21	13 55 00.323 ^{128.521}	10 27 45.07 ^{896.50}
22	12 16 03.992 ^{125.976}	1 56 58.97 ^{972.90}	22	13 57 08.844 ^{128.688}	10 42 41.57 ^{892.89}
23	12 18 09.968 ^{125.913}	1 40 46.07 ^{-973.19}	23	13 59 17.532 ^{128.861}	10 57 34.46 ^{-889.21}
24	12 20 15.881	+ 1 24 32.88	24	14 01 26.393	- 11 12 23.67

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 5			January 7		
h	h m s	° ' "	h	h m s	° ' "
0	14 01 26.393	-11 12 23.67	0	15 48 54.829	-21 24 42.11
1	14 03 35.429	-11 27 09.11	1	15 51 15.412	-21 34 50.72
2	14 05 44.645	-11 41 50.70	2	15 53 36.255	-21 44 51.64
3	14 07 54.046	-11 56 28.35	3	15 55 57.357	-21 54 44.80
4	14 10 03.634	-12 11 01.99	4	15 58 18.717	-22 04 30.13
5	14 12 13.413	-12 25 31.53	5	16 00 40.332	-22 14 07.56
6	14 14 23.388	-12 39 56.90	6	16 03 02.201	-22 23 37.01
7	14 16 33.562	-12 54 18.00	7	16 05 24.321	-22 32 58.42
8	14 18 43.938	-13 08 34.75	8	16 07 46.692	-22 42 11.72
9	14 20 54.520	-13 22 47.08	9	16 10 09.309	-22 51 16.84
10	14 23 05.311	-13 36 54.90	10	16 12 32.171	-23 00 13.72
11	14 25 16.315	-13 50 58.12	11	16 14 55.275	-23 09 02.29
12	14 27 27.535	-14 04 56.67	12	16 17 18.618	-23 17 42.49
13	14 29 38.974	-14 18 50.46	13	16 19 42.198	-23 26 14.25
14	14 31 50.635	-14 32 39.41	14	16 22 06.010	-23 34 37.51
15	14 34 02.521	-14 46 23.44	15	16 24 30.052	-23 42 52.21
16	14 36 14.635	-15 00 02.47	16	16 26 54.321	-23 50 58.28
17	14 38 26.981	-15 13 36.40	17	16 29 18.812	-23 58 55.67
18	14 40 39.560	-15 27 05.17	18	16 31 43.522	-24 06 44.32
19	14 42 52.375	-15 40 28.69	19	16 34 08.447	-24 14 24.18
20	14 45 05.430	-15 53 46.87	20	16 36 33.583	-24 21 55.17
21	14 47 18.725	-16 06 59.64	21	16 38 58.925	-24 29 17.26
22	14 49 32.264	-16 20 06.91	22	16 41 24.470	-24 36 30.39
23	14 51 46.050	-16 33 08.60	23	16 43 50.212	-24 43 34.50
	134.933	-776.03		145.936	-415.04
January 6			January 8		
h	h m s	° ' "	h	h m s	° ' "
0	14 54 00.083	-16 46 04.63	0	16 46 16.148	-24 50 29.54
1	14 56 14.366	-16 58 54.91	1	16 48 42.272	-24 57 15.46
2	14 58 28.902	-17 11 39.37	2	16 51 08.578	-25 03 52.22
3	15 00 43.691	-17 24 17.93	3	16 53 35.063	-25 10 19.76
4	15 02 58.736	-17 36 50.50	4	16 56 01.721	-25 16 38.05
5	15 05 14.038	-17 49 17.00	5	16 58 28.546	-25 22 47.02
6	15 07 29.598	-18 01 37.36	6	17 00 55.533	-25 28 46.65
7	15 09 45.418	-18 13 51.49	7	17 03 22.677	-25 34 36.89
8	15 12 01.500	-18 25 59.30	8	17 05 49.970	-25 40 17.70
9	15 14 17.844	-18 38 00.73	9	17 08 17.408	-25 45 49.04
10	15 16 34.451	-18 49 55.69	10	17 10 44.985	-25 51 10.87
11	15 18 51.323	-19 01 44.10	11	17 13 12.694	-25 56 23.16
12	15 21 08.459	-19 13 25.89	12	17 15 40.528	-26 01 25.87
13	15 23 25.860	-19 25 00.97	13	17 18 08.483	-26 06 18.97
14	15 25 43.528	-19 36 29.26	14	17 20 36.550	-26 11 02.43
15	15 28 01.462	-19 47 50.69	15	17 23 04.723	-26 15 36.22
16	15 30 19.662	-19 59 05.18	16	17 25 32.996	-26 20 00.31
17	15 32 38.128	-20 10 12.66	17	17 28 01.362	-26 24 14.68
18	15 34 56.861	-20 21 13.04	18	17 30 29.814	-26 28 19.30
19	15 37 15.860	-20 32 06.25	19	17 32 58.345	-26 32 14.14
20	15 39 35.125	-20 42 52.21	20	17 35 26.947	-26 35 59.19
21	15 41 54.655	-20 53 30.85	21	17 37 55.614	-26 39 34.43
22	15 44 14.450	-21 04 02.10	22	17 40 24.337	-26 42 59.84
23	15 46 34.508	-21 14 25.88	23	17 42 53.111	-26 46 15.41
24	15 48 54.829	-21 24 42.11	24	17 45 21.927	-26 49 21.11
		-616.23			-185.70

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 9			January 11		
^b 0	^{h m s} 17 45 21.927	^{° ' "} 148.852 -26 49 21.11	^h 0	^{h m s} 19 42 45.862	^{° ' "} 141.767 -26 07 21.97
1	17 47 50.779	148.878 26 52 16.94	1	19 45 07.629	141.463 26 02 43.34
2	17 50 19.657	148.899 26 55 02.89	2	19 47 29.092	141.153 25 57 56.29
3	17 52 48.556	148.910 26 57 38.94	3	19 49 50.245	140.840 25 53 00.86
4	17 55 17.466	148.916 27 00 05.10	4	19 52 11.085	140.522 25 47 57.14
5	17 57 46.382	148.912 27 02 21.35	5	19 54 31.607	140.201 25 42 45.18
6	18 00 15.294	148.901 27 04 27.70	6	19 56 51.808	139.875 25 37 25.05
7	18 02 44.195	148.882 27 06 24.13	7	19 59 11.683	139.545 25 31 56.82
8	18 05 13.077	148.855 27 08 10.65	8	20 01 31.228	139.213 25 26 20.55
9	18 07 41.932	148.822 27 09 47.27	9	20 03 50.441	138.875 25 20 36.31
10	18 10 10.754	148.779 27 11 13.99	10	20 06 09.316	138.536 25 14 44.18
11	18 12 39.533	148.729 27 12 30.80	11	20 08 27.852	138.192 25 08 44.21
12	18 15 08.262	148.671 27 13 37.73	12	20 10 46.044	137.846 25 02 36.49
13	18 17 36.933	148.605 27 14 34.77	13	20 13 03.890	137.497 24 56 21.07
14	18 20 05.538	148.532 27 15 21.94	14	20 15 21.387	137.146 24 49 58.04
15	18 22 34.070	148.450 27 15 59.26	15	20 17 38.533	136.790 24 43 27.46
16	18 25 02.520	148.361 27 16 26.73	16	20 19 55.323	136.434 24 36 49.40
17	18 27 30.881	148.264 27 16 44.37	17	20 22 11.757	136.074 24 30 03.94
18	18 29 59.145	148.160 27 16 52.21	18	20 24 27.831	135.713 24 23 11.15
19	18 32 27.305	148.047 27 16 50.25	19	20 26 43.544	135.350 24 16 11.10
20	18 34 55.352	147.927 27 16 38.53	20	20 28 58.894	134.984 24 09 03.87
21	18 37 23.279	147.799 27 16 17.06	21	20 31 13.878	134.617 24 01 49.53
22	18 39 51.078	147.664 27 15 45.88	22	20 33 28.495	134.249 23 54 28.15
23	18 42 18.742	147.522 -27 15 05.00	23	20 35 42.744	133.878 -23 46 59.82
					+455.23
January 10			January 12		
0	18 44 46.264	147.371 -27 14 14.45	0	20 37 56.622	133.507 -23 39 24.59
1	18 47 13.635	147.213 27 13 14.27	1	20 40 10.129	133.134 23 31 42.55
2	18 49 40.848	147.049 27 12 04.48	2	20 42 23.263	132.761 23 23 53.78
3	18 52 07.897	146.876 27 10 45.12	3	20 44 36.024	132.387 23 15 58.34
4	18 54 34.773	146.697 27 09 16.23	4	20 46 48.411	132.011 23 07 56.32
5	18 57 01.470	146.511 27 07 37.83	5	20 49 00.422	131.636 22 59 47.78
6	18 59 27.981	146.318 27 05 49.97	6	20 51 12.058	131.259 22 51 32.80
7	19 01 54.299	146.117 27 03 52.69	7	20 53 23.317	130.882 22 43 11.47
8	19 04 20.416	145.911 27 01 46.03	8	20 55 34.199	130.505 22 34 43.85
9	19 06 46.327	145.696 26 59 30.03	9	20 57 44.704	130.129 22 26 10.01
10	19 09 12.023	145.477 26 57 04.73	10	20 59 54.833	129.751 22 17 30.04
11	19 11 37.500	145.250 26 54 30.18	11	21 02 04.584	129.375 22 08 44.01
12	19 14 02.750	145.016 26 51 46.42	12	21 04 13.959	128.998 21 59 52.00
13	19 16 27.766	144.777 26 48 53.51	13	21 06 22.957	128.622 21 50 54.07
14	19 18 52.543	144.532 26 45 51.48	14	21 08 31.579	128.246 21 41 50.31
15	19 21 17.075	144.280 26 42 40.40	15	21 10 39.825	127.870 21 32 40.78
16	19 23 41.355	144.023 26 39 20.32	16	21 12 47.695	127.497 21 23 25.57
17	19 26 05.378	143.760 26 35 51.28	17	21 14 55.192	127.123 21 14 04.75
18	19 28 29.138	143.490 26 32 13.34	18	21 17 02.315	126.750 21 04 38.39
19	19 30 52.628	143.217 26 28 26.55	19	21 19 09.065	126.379 20 55 06.57
20	19 33 15.845	142.937 26 24 30.98	20	21 21 15.444	126.008 20 45 29.35
21	19 35 38.782	142.651 26 20 26.68	21	21 23 21.452	125.639 20 35 46.82
22	19 38 01.433	142.362 26 16 13.70	22	21 25 27.091	125.271 20 25 59.04
23	19 40 23.795	142.067 26 11 52.11	23	21 27 32.362	124.905 20 16 06.10
24	19 42 45.862	-26 07 21.97	24	21 29 37.267	+598.05

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 13			January 15		
h	h m s	° ' "	h	h m s	° ' "
0	21 29 37.267	-20 06 08.05	0	23 03 09.539	-10 49 49.52
1	21 31 41.807	19 56 04.98	1	23 04 59.777	10 37 01.98
2	21 33 45.984	19 45 56.96	2	23 06 49.803	10 24 12.42
3	21 35 49.800	19 35 44.05	3	23 08 39.623	10 11 20.89
4	21 37 53.256	19 25 26.33	4	23 10 29.240	9 58 27.44
5	21 39 56.354	19 15 03.87	5	23 12 18.659	9 45 32.12
6	21 41 59.096	19 04 36.75	6	23 14 07.883	9 32 34.98
7	21 44 01.485	18 54 05.02	7	23 15 56.918	9 19 36.07
8	21 46 03.522	18 43 28.76	8	23 17 45.766	9 06 35.43
9	21 48 05.210	18 32 48.04	9	23 19 34.432	8 53 33.11
10	21 50 06.551	18 22 02.94	10	23 21 22.920	8 40 29.16
11	21 52 07.547	18 11 13.51	11	23 23 11.236	8 27 23.62
12	21 54 08.202	18 00 19.82	12	23 24 59.382	8 14 16.54
13	21 56 08.516	17 49 21.95	13	23 26 47.363	8 01 07.97
14	21 58 08.494	17 38 19.95	14	23 28 35.183	7 47 57.96
15	22 00 08.138	17 27 13.91	15	23 30 22.848	7 34 46.53
16	22 02 07.450	17 16 03.88	16	23 32 10.360	7 21 33.75
17	22 04 06.433	17 04 49.92	17	23 33 57.724	7 08 19.66
18	22 06 05.090	16 53 32.11	18	23 35 44.945	6 55 04.29
19	22 08 03.424	16 42 10.51	19	23 37 32.027	6 41 47.70
20	22 10 01.439	16 30 45.19	20	23 39 18.973	6 28 29.93
21	22 11 59.136	16 19 16.20	21	23 41 05.790	6 15 11.02
22	22 13 56.520	16 07 43.61	22	23 42 52.480	6 01 51.01
23	22 15 53.592	-15 56 07.49	23	23 44 39.049	-5 48 29.94
	116.766	+699.60		106.451	+802.08
January 14			January 16		
0	22 17 50.358	-15 44 27.89	0	23 46 25.500	-5 35 07.86
1	22 19 46.819	15 32 44.89	1	23 48 11.839	5 21 44.81
2	22 21 42.979	15 20 58.53	2	23 49 58.068	5 08 20.83
3	22 23 38.841	15 09 08.88	3	23 51 44.194	4 54 55.97
4	22 25 34.409	14 57 16.01	4	23 53 30.219	4 41 30.26
5	22 27 29.686	14 45 19.97	5	23 55 16.150	4 28 03.74
6	22 29 24.676	14 33 20.81	6	23 57 01.989	4 14 36.46
7	22 31 19.382	14 21 18.61	7	23 58 47.742	4 01 08.45
8	22 33 13.808	14 09 13.42	8	0 00 33.413	3 47 39.76
9	22 35 07.957	13 57 05.30	9	0 02 19.006	3 34 10.43
10	22 37 01.834	13 44 54.30	10	0 04 04.526	3 20 40.49
11	22 38 55.440	13 32 40.48	11	0 05 49.977	3 07 09.98
12	22 40 48.781	13 20 23.90	12	0 07 35.364	2 53 38.95
13	22 42 41.860	13 08 04.62	13	0 09 20.690	2 40 07.44
14	22 44 34.681	12 55 42.69	14	0 11 05.962	2 26 35.48
15	22 46 27.248	12 43 18.16	15	0 12 51.183	2 13 03.11
16	22 48 19.564	12 30 51.09	16	0 14 36.357	1 59 30.37
17	22 50 11.633	12 18 21.54	17	0 16 21.490	1 45 57.30
18	22 52 03.459	12 05 49.55	18	0 18 06.585	1 32 23.94
19	22 53 55.047	11 53 15.19	19	0 19 51.647	1 18 50.33
20	22 55 46.399	11 40 38.50	20	0 21 36.680	1 05 16.50
21	22 57 37.521	11 27 59.53	21	0 23 21.690	0 51 42.50
22	22 59 28.415	11 15 18.35	22	0 25 06.681	0 38 08.35
23	23 01 19.087	11 02 35.00	23	0 26 51.656	0 24 34.11
24	23 03 09.539	-10 49 49.52	24	0 28 36.621	-0 10 59.80
	110.452	+765.48		104.965	+814.31

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 17			January 19		
h	h m s	° ' " s	h	h m s	° ' " s
0	0 28 36.621	104.960	0	1 53 52.369	+10 29 06.89
1	0 30 21.581	104.958	1	1 55 42.440	+10 41 56.45
2	0 32 06.539	104.961	2	1 57 32.729	+10 54 44.04
3	0 33 51.500	104.969	3	1 59 23.243	+11 07 29.61
4	0 35 36.469	104.981	4	2 01 13.985	+11 20 13.12
5	0 37 21.450	104.999	5	2 03 04.960	+11 32 54.51
6	0 39 06.449	105.019	6	2 04 56.172	+11 45 33.74
7	0 40 51.468	105.046	7	2 06 47.626	+11 58 10.76
8	0 42 36.514	105.076	8	2 08 39.327	+12 10 45.51
9	0 44 21.590	105.111	9	2 10 31.279	+12 23 17.96
10	0 46 06.701	105.152	10	2 12 23.486	+12 35 48.03
11	0 47 51.853	105.195	11	2 14 15.953	+12 48 15.70
12	0 49 37.048	105.244	12	2 16 08.685	+13 00 40.89
13	0 51 22.292	105.297	13	2 18 01.686	+13 13 03.56
14	0 53 07.589	105.356	14	2 19 54.959	+13 25 23.67
15	0 54 52.945	105.418	15	2 21 48.511	+13 37 41.14
16	0 56 38.363	105.485	16	2 23 42.344	+13 49 55.93
17	0 58 23.848	105.557	17	2 25 36.464	+14 02 07.99
18	1 00 09.405	105.634	18	2 27 30.875	+14 14 17.25
19	1 01 55.039	105.714	19	2 29 25.580	+14 26 23.67
20	1 03 40.753	105.800	20	2 31 20.585	+14 38 27.18
21	1 05 26.553	105.890	21	2 33 15.894	+14 50 27.74
22	1 07 12.443	105.985	22	2 35 11.511	+15 02 25.27
23	1 08 58.428	106.085	23	2 37 07.439	+15 14 19.73
					+15 26 11.05
January 18			January 20		
0	1 10 44.513	106.188	0	2 39 03.684	+15 26 11.05
1	1 12 30.701	106.297	1	2 41 00.249	+15 37 59.18
2	1 14 16.998	106.410	2	2 42 57.138	+15 49 44.06
3	1 16 03.408	106.528	3	2 44 54.357	+16 01 25.61
4	1 17 49.936	106.651	4	2 46 51.907	+16 13 03.80
5	1 19 36.587	106.778	5	2 48 49.795	+16 24 38.54
6	1 21 23.365	106.909	6	2 50 48.022	+16 36 09.78
7	1 23 10.274	107.046	7	2 52 46.595	+16 47 37.46
8	1 24 57.320	107.187	8	2 54 45.515	+16 59 01.51
9	1 26 44.507	107.332	9	2 56 44.788	+17 10 21.87
10	1 28 31.839	107.483	10	2 58 44.417	+17 21 38.47
11	1 30 19.322	107.638	11	3 00 44.405	+17 32 51.25
12	1 32 06.960	107.797	12	3 02 44.757	+17 44 00.14
13	1 33 54.757	107.961	13	3 04 45.476	+17 55 05.07
14	1 35 42.718	108.130	14	3 06 46.565	+18 06 05.98
15	1 37 30.848	108.303	15	3 08 48.028	+18 17 02.80
16	1 39 19.151	108.481	16	3 10 49.869	+18 27 55.45
17	1 41 07.632	108.664	17	3 12 52.091	+18 38 43.88
18	1 42 56.296	108.851	18	3 14 54.697	+18 49 28.00
19	1 44 45.147	109.042	19	3 16 57.690	+19 00 07.75
20	1 46 34.189	109.239	20	3 19 01.074	+19 10 43.06
21	1 48 23.428	109.440	21	3 21 04.852	+19 21 13.86
22	1 50 12.868	109.646	22	3 23 09.027	+19 31 40.07
23	1 52 02.514	109.855	23	3 25 13.602	+19 42 01.61
24	1 53 52.369		24	3 27 18.579	+19 52 18.43

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 21			January 23		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	3 27 18.579	+19 52 18.43	0	5 15 40.878	+26 06 45.34
1	3 29 23.962	20 02 30.43	1	5 18 06.744	26 11 30.38
2	3 31 29.753	20 12 37.55	2	5 20 32.996	26 16 06.55
3	3 33 35.955	20 22 39.71	3	5 22 59.631	26 20 33.77
4	3 35 42.571	20 32 36.83	4	5 25 26.643	26 24 51.97
5	3 37 49.602	20 42 28.84	5	5 27 54.028	26 29 01.05
6	3 39 57.052	20 52 15.65	6	5 30 21.780	26 33 00.96
7	3 42 04.922	21 01 57.20	7	5 32 49.894	26 36 51.60
8	3 44 13.215	21 11 33.40	8	5 35 18.365	26 40 32.91
9	3 46 21.932	21 21 04.18	9	5 37 47.187	26 44 04.81
10	3 48 31.077	21 30 29.44	10	5 40 16.354	26 47 27.22
11	3 50 40.649	21 39 49.13	11	5 42 45.861	26 50 40.09
12	3 52 50.652	21 49 03.14	12	5 45 15.700	26 53 43.33
13	3 55 01.087	21 58 11.41	13	5 47 45.866	26 56 36.88
14	3 57 11.956	22 07 13.84	14	5 50 16.352	26 59 20.66
15	3 59 23.259	22 16 10.37	15	5 52 47.151	27 01 54.62
16	4 01 34.998	22 25 00.90	16	5 55 18.257	27 04 18.68
17	4 03 47.174	22 33 45.35	17	5 57 49.662	27 06 32.79
18	4 05 59.788	22 42 23.65	18	6 00 21.359	27 08 36.87
19	4 08 12.841	22 50 55.69	19	6 02 53.341	27 10 30.88
20	4 10 26.334	22 59 21.41	20	6 05 25.600	27 12 14.74
21	4 12 40.268	23 07 40.72	21	6 07 58.128	27 13 48.41
22	4 14 54.642	23 15 53.53	22	6 10 30.919	27 15 11.82
23	4 17 09.457	+23 23 59.76	23	6 13 03.963	+27 16 24.92
	135.257	+479.56		153.290	+62.74
January 22			January 24		
0	4 19 24.714	+23 31 59.32	0	6 15 37.253	+27 17 27.66
1	4 21 40.412	23 39 52.13	1	6 18 10.781	27 18 19.99
2	4 23 56.551	23 47 38.10	2	6 20 44.538	27 19 01.85
3	4 26 13.131	23 55 17.15	3	6 23 18.516	27 19 33.21
4	4 28 30.151	24 02 49.18	4	6 25 52.705	27 19 54.01
5	4 30 47.611	24 10 14.12	5	6 28 27.099	27 20 04.21
6	4 33 05.511	24 17 31.87	6	6 31 01.687	27 20 03.77
7	4 35 23.848	24 24 42.36	7	6 33 36.460	27 19 52.66
8	4 37 42.623	24 31 45.49	8	6 36 11.411	27 19 30.82
9	4 40 01.833	24 38 41.18	9	6 38 46.529	27 18 58.24
10	4 42 21.477	24 45 29.34	10	6 41 21.806	27 18 14.87
11	4 44 41.554	24 52 09.89	11	6 43 57.232	27 17 20.69
12	4 47 02.063	24 58 42.74	12	6 46 32.799	27 16 15.66
13	4 49 23.000	25 05 07.81	13	6 49 08.496	27 14 59.76
14	4 51 44.364	25 11 25.00	14	6 51 44.315	27 13 32.97
15	4 54 06.152	25 17 34.23	15	6 54 20.245	27 11 55.26
16	4 56 28.363	25 23 35.43	16	6 56 56.278	27 10 06.61
17	4 58 50.992	25 29 28.49	17	6 59 32.404	27 08 07.01
18	5 01 14.039	25 35 13.34	18	7 02 08.614	27 05 56.43
19	5 03 37.498	25 40 49.90	19	7 04 44.897	27 03 34.88
20	5 06 01.368	25 46 18.08	20	7 07 21.245	27 01 02.33
21	5 08 25.645	25 51 37.80	21	7 09 57.647	26 58 18.79
22	5 10 50.324	25 56 48.97	22	7 12 34.095	26 55 24.23
23	5 13 15.403	26 01 51.51	23	7 15 10.578	26 52 18.67
24	5 15 40.878	+26 06 45.34	24	7 17 47.087	+26 49 02.10
	145.475	+293.83		156.509	-196.57

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 25			January 27		
0	7 17 47.087 156.526	+26 49 02.10 -207.58	0	9 20 44.694 148.156	+20 45 35.37 -688.76
1	7 20 23.613 156.533	26 45 34.52 218.59	1	9 23 12.850 147.854	20 34 06.61 696.98
2	7 23 00.146 156.531	26 41 55.93 229.58	2	9 25 40.704 147.551	20 22 29.63 705.11
3	7 25 36.677 156.519	26 38 06.35 240.57	3	9 28 08.255 147.246	20 10 44.52 713.13
4	7 28 13.196 156.498	26 34 05.78 251.55	4	9 30 35.501 146.939	19 58 51.39 721.06
5	7 30 49.694 156.468	26 29 54.23 262.52	5	9 33 02.440 146.630	19 46 50.33 728.89
6	7 33 26.162 156.429	26 25 31.71 273.45	6	9 35 29.070 146.320	19 34 41.44 736.60
7	7 36 02.591 156.380	26 20 58.26 284.39	7	9 37 55.390 146.008	19 22 24.84 744.22
8	7 38 38.971 156.322	26 16 13.87 295.30	8	9 40 21.398 145.697	19 10 00.62 751.72
9	7 41 15.293 156.256	26 11 18.57 306.17	9	9 42 47.095 145.384	18 57 28.90 759.14
10	7 43 51.549 156.180	26 06 12.40 317.04	10	9 45 12.479 145.070	18 44 49.76 766.43
11	7 46 27.729 156.096	26 00 55.36 327.86	11	9 47 37.549 144.757	18 32 03.33 773.63
12	7 49 03.825 156.003	25 55 27.50 338.66	12	9 50 02.306 144.442	18 19 09.70 780.71
13	7 51 39.828 155.902	25 49 48.84 349.43	13	9 52 26.748 144.127	18 06 08.99 787.68
14	7 54 15.730 155.791	25 43 59.41 360.16	14	9 54 50.875 143.813	17 53 01.31 794.55
15	7 56 51.521 155.674	25 37 59.25 370.84	15	9 57 14.688 143.499	17 39 46.76 801.32
16	7 59 27.195 155.547	25 31 48.41 381.50	16	9 59 38.187 143.185	17 26 25.44 807.96
17	8 02 02.742 155.413	25 25 26.91 392.11	17	10 02 01.372 142.872	17 12 57.48 814.49
18	8 04 38.155 155.271	25 18 54.80 402.67	18	10 04 24.244 142.559	16 59 22.99 820.93
19	8 07 13.426 155.120	25 12 12.13 413.18	19	10 06 46.803 142.247	16 45 42.06 827.24
20	8 09 48.546 154.963	25 05 18.95 423.66	20	10 09 09.050 141.936	16 31 54.82 833.44
21	8 12 23.509 154.798	24 58 15.29 434.07	21	10 11 30.986 141.626	16 18 01.38 839.54
22	8 14 58.307 154.625	24 51 01.22 444.43	22	10 13 52.612 141.318	16 04 01.84 845.52
23	8 17 32.932 154.446	+24 43 36.79 -454.74	23	10 16 13.930 141.011	+15 49 56.32 -851.38
January 26			January 28		
0	8 20 07.378 154.259	+24 36 02.05 -464.99	0	10 18 34.941 140.795	+15 35 44.94 -857.14
1	8 22 41.637 154.065	24 28 17.06 475.18	1	10 20 55.646 140.401	15 21 27.80 862.78
2	8 25 15.702 153.866	24 20 21.88 485.30	2	10 23 16.047 140.099	15 07 05.02 868.31
3	8 27 49.568 153.658	24 12 16.58 495.37	3	10 25 36.146 139.799	14 52 36.71 873.73
4	8 30 23.226 153.447	24 04 01.21 505.37	4	10 27 55.945 139.501	14 38 02.98 879.03
5	8 32 56.673 153.227	23 55 35.84 515.29	5	10 30 15.446 139.205	14 23 23.95 884.21
6	8 35 29.900 153.002	23 47 00.55 525.15	6	10 32 34.651 138.911	14 08 39.74 889.29
7	8 38 02.902 152.771	23 38 15.40 534.94	7	10 34 53.562 138.620	13 53 50.45 894.26
8	8 40 35.673 152.536	23 29 20.46 544.66	8	10 37 12.182 138.331	13 38 56.19 899.10
9	8 43 08.209 152.294	23 20 15.80 554.29	9	10 39 30.513 138.045	13 23 57.09 903.83
10	8 45 40.503 152.047	23 11 01.51 563.86	10	10 41 48.558 137.762	13 08 53.26 908.46
11	8 48 12.550 151.795	23 01 37.65 573.34	11	10 44 06.320 137.482	12 53 44.80 912.96
12	8 50 44.345 151.538	22 52 04.31 582.74	12	10 46 23.802 137.204	12 38 31.84 917.36
13	8 53 15.883 151.278	22 42 21.57 592.06	13	10 48 41.006 136.929	12 23 14.48 921.64
14	8 55 47.161 151.012	22 32 29.51 601.30	14	10 50 57.935 136.659	12 07 52.84 925.81
15	8 58 18.173 150.741	22 22 28.21 610.45	15	10 53 14.594 136.390	11 52 27.03 929.86
16	9 00 48.914 150.469	22 12 17.76 619.52	16	10 55 30.984 136.125	11 36 57.17 933.80
17	9 03 19.383 150.190	22 01 58.24 628.49	17	10 57 47.109 135.864	11 21 23.37 937.63
18	9 05 49.573 149.909	21 51 29.75 637.38	18	11 00 02.973 135.607	11 05 45.74 941.34
19	9 08 19.482 149.624	21 40 52.37 646.18	19	11 02 18.580 135.352	10 50 04.40 944.96
20	9 10 49.106 149.337	21 30 06.19 654.88	20	11 04 33.932 135.101	10 34 19.44 948.44
21	9 13 18.443 149.045	21 19 11.31 663.50	21	11 06 49.033 134.855	10 18 31.00 951.82
22	9 15 47.488 148.751	21 08 07.81 672.01	22	11 09 03.888 134.612	10 02 39.18 955.09
23	9 18 16.239 148.455	20 56 55.80 680.43	23	11 11 18.500 134.373	9 46 44.09 958.25
24	9 20 44.694	+20 45 35.37	24	11 13 32.873	+9 30 45.84

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
January 29			January 31		
h	h m s	° ' "	h	h m s	° ' "
0	11 13 32.873	+ 9 30 45.84	0	12 57 49.979	- 3 42 56.94
1	11 15 47.010	9 14 44.55	1	12 59 58.305	3 59 21.78
2	11 18 00.917	8 58 40.32	2	13 02 06.633	4 15 44.73
3	11 20 14.596	8 42 33.26	3	13 04 14.965	4 32 05.71
4	11 22 28.053	8 26 23.49	4	13 06 23.308	4 48 24.63
5	11 24 41.291	8 10 11.12	5	13 08 31.666	5 04 41.39
6	11 26 54.315	7 53 56.25	6	13 10 40.044	5 20 55.92
7	11 29 07.128	7 37 38.99	7	13 12 48.447	5 37 08.12
8	11 31 19.736	7 21 19.45	8	13 14 56.880	5 53 17.90
9	11 33 32.143	7 04 57.75	9	13 17 05.347	6 09 25.18
10	11 35 44.353	6 48 33.97	10	13 19 13.853	6 25 29.87
11	11 37 56.371	6 32 08.25	11	13 21 22.404	6 41 31.88
12	11 40 08.201	6 15 40.68	12	13 23 31.003	6 57 31.13
13	11 42 19.848	5 59 11.36	13	13 25 39.655	7 13 27.53
14	11 44 31.317	5 42 40.41	14	13 27 48.365	7 29 21.00
15	11 46 42.612	5 26 07.93	15	13 29 57.138	7 45 11.45
16	11 48 53.738	5 09 34.02	16	13 32 05.978	8 00 58.79
17	11 51 04.699	4 52 58.80	17	13 34 14.890	8 16 42.95
18	11 53 15.502	4 36 22.36	18	13 36 23.877	8 32 23.84
19	11 55 26.149	4 19 44.81	19	13 38 32.946	8 48 01.37
20	11 57 36.647	4 03 06.25	20	13 40 42.100	9 03 35.46
21	11 59 47.000	3 46 26.78	21	13 42 51.342	9 19 06.03
22	12 01 57.213	3 29 46.52	22	13 45 00.679	9 34 32.99
23	12 04 07.291	+ 3 13 05.55	23	13 47 10.114	- 9 49 56.27
	129.947	-1001.56		129.537	-919.51
January 30			February 1		
0	12 06 17.238	+ 2 56 23.99	0	13 49 19.651	-10 05 15.78
1	12 08 27.061	2 39 41.92	1	13 51 29.294	10 20 31.44
2	12 10 36.763	2 22 59.46	2	13 53 39.048	10 35 43.17
3	12 12 46.350	2 06 16.71	3	13 55 48.917	10 50 50.88
4	12 14 55.827	1 49 33.76	4	13 57 58.904	11 05 54.50
5	12 17 05.199	1 32 50.71	5	14 00 09.014	11 20 53.94
6	12 19 14.470	1 16 07.66	6	14 02 19.250	11 35 49.13
7	12 21 23.646	0 59 24.71	7	14 04 29.617	11 50 39.98
8	12 23 32.732	0 42 41.96	8	14 06 40.118	12 05 26.42
9	12 25 41.733	0 25 59.51	9	14 08 50.757	12 20 08.37
10	12 27 50.654	+ 0 09 17.45	10	14 11 01.538	12 34 45.74
11	12 29 59.500	- 0 07 24.12	11	14 13 12.464	12 49 18.46
12	12 32 08.276	0 24 05.11	12	14 15 23.538	13 03 46.45
13	12 34 16.988	0 40 45.42	13	14 17 34.765	13 18 09.63
14	12 36 25.639	0 57 24.95	14	14 19 46.148	13 32 27.93
15	12 38 34.236	1 14 03.61	15	14 21 57.689	13 46 41.26
16	12 40 42.783	1 30 41.30	16	14 24 09.393	14 00 49.55
17	12 42 51.286	1 47 17.93	17	14 26 21.263	14 14 52.72
18	12 44 59.749	2 03 53.42	18	14 28 33.301	14 28 50.70
19	12 47 08.178	2 20 27.65	19	14 30 45.510	14 42 43.40
20	12 49 16.577	2 37 00.55	20	14 32 57.895	14 56 30.76
21	12 51 24.951	2 53 32.02	21	14 35 10.456	15 10 12.70
22	12 53 33.307	3 10 01.97	22	14 37 23.198	15 23 49.14
23	12 55 41.647	3 26 30.31	23	14 39 36.123	15 37 20.00
24	12 57 49.979	- 3 42 56.94	24	14 41 49.234	-15 50 45.22

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 2			February 4		
h	h m s	° ' "	h	h m s	° ' "
0	14 41 49.234	133.298	0	16 32 22.431	143.190
1	14 44 02.532	133.490	1	16 34 45.621	143.363
2	14 46 16.022	133.682	2	16 37 08.984	143.533
3	14 48 29.704	133.877	3	16 39 32.517	143.698
4	14 50 43.581	134.075	4	16 41 56.215	143.861
5	14 52 57.656	134.275	5	16 44 20.076	144.019
6	14 55 11.931	134.475	6	16 46 44.095	144.172
7	14 57 26.406	134.679	7	16 49 08.267	144.323
8	14 59 41.085	134.885	8	16 51 32.590	144.468
9	15 01 55.970	135.090	9	16 53 57.058	144.609
10	15 04 11.060	135.300	10	16 56 21.667	144.746
11	15 06 26.360	135.509	11	16 58 46.413	144.878
12	15 08 41.869	135.720	12	17 01 11.291	145.004
13	15 10 57.589	135.932	13	17 03 36.295	145.127
14	15 13 13.521	136.146	14	17 06 01.422	145.244
15	15 15 29.667	136.360	15	17 08 26.666	145.356
16	15 17 46.027	136.576	16	17 10 52.022	145.462
17	15 20 02.603	136.792	17	17 13 17.484	145.564
18	15 22 19.395	137.009	18	17 15 43.048	145.660
19	15 24 36.404	137.226	19	17 18 08.708	145.750
20	15 26 53.630	137.444	20	17 20 34.458	145.835
21	15 29 11.074	137.662	21	17 23 00.293	145.914
22	15 31 28.736	137.880	22	17 25 26.207	145.987
23	15 33 46.616	138.099	23	17 27 52.194	146.055
February 3			February 5		
h	h m s	° ' "	h	h m s	° ' "
0	15 36 04.715	138.317	0	17 30 18.249	146.116
1	15 38 23.032	138.535	1	17 32 44.365	146.171
2	15 40 41.567	138.753	2	17 35 10.536	146.220
3	15 43 00.320	138.970	3	17 37 36.756	146.264
4	15 45 19.290	139.186	4	17 40 03.020	146.300
5	15 47 38.476	139.403	5	17 42 29.320	146.330
6	15 49 57.879	139.618	6	17 44 55.650	146.355
7	15 52 17.497	139.832	7	17 47 22.005	146.372
8	15 54 37.329	140.045	8	17 49 48.377	146.383
9	15 56 57.374	140.256	9	17 52 14.760	146.387
10	15 59 17.630	140.467	10	17 54 41.147	146.386
11	16 01 38.097	140.676	11	17 57 07.533	146.377
12	16 03 58.773	140.883	12	17 59 33.910	146.361
13	16 06 19.656	141.089	13	18 02 00.271	146.340
14	16 08 40.745	141.292	14	18 04 26.611	146.311
15	16 11 02.037	141.493	15	18 06 52.922	146.276
16	16 13 23.530	141.692	16	18 09 19.198	146.233
17	16 15 45.222	141.889	17	18 11 45.431	146.185
18	16 18 07.111	142.084	18	18 14 11.616	146.129
19	16 20 29.195	142.275	19	18 16 37.745	146.067
20	16 22 51.470	142.464	20	18 19 03.812	145.997
21	16 25 13.934	142.651	21	18 21 29.809	145.922
22	16 27 36.585	142.833	22	18 23 55.731	145.839
23	16 29 59.418	143.013	23	18 26 21.570	145.749
24	16 32 22.431		24	18 28 47.319	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
February 6									February 8								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	18 28	47.3	19	145.654	-27 23	49.57	+	4.72	0	20 21	40.3	29	134.458	-24 32	15.67	+	414.30
1	18 31	12.9	73	145.551	27 23	44.85	+	14.18	1	20 23	54.7	87	134.128	24 25	21.37	+	421.48
2	18 33	38.5	24	145.442	27 23	30.67		23.63	2	20 26	08.9	15	133.797	24 18	19.89		428.58
3	18 36	03.9	66	145.325	27 23	07.04		33.05	3	20 28	22.7	12	133.463	24 11	11.31		435.63
4	18 38	29.2	91	145.203	27 22	33.99		42.44	4	20 30	36.1	75	133.128	24 03	55.68		442.60
5	18 40	54.4	94	145.074	27 21	51.55		51.82	5	20 32	49.3	03	132.792	23 56	33.08		449.52
6	18 43	19.5	68	144.938	27 20	59.73		61.16	6	20 35	02.0	95	132.454	23 49	03.56		456.35
7	18 45	44.5	06	144.797	27 19	58.57		70.48	7	20 37	14.5	49	132.114	23 41	27.21		463.13
8	18 48	09.3	03	144.647	27 18	48.09		79.77	8	20 39	26.6	63	131.774	23 33	44.08		469.82
9	18 50	33.9	50	144.493	27 17	28.32		89.02	9	20 41	38.4	37	131.431	23 25	54.26		476.47
10	18 52	58.4	43	144.332	27 15	59.30		98.26	10	20 43	49.8	68	131.090	23 17	57.79		483.03
11	18 55	22.7	75	144.165	27 14	21.04		107.45	11	20 46	00.9	58	130.746	23 09	54.76		489.52
12	18 57	46.9	40	143.991	27 12	33.59		116.61	12	20 48	11.7	04	130.401	23 01	45.24		495.95
13	19 00	10.9	31	143.812	27 10	36.98		125.73	13	20 50	22.1	05	130.057	22 53	29.29		502.31
14	19 02	34.7	43	143.626	27 08	31.25		134.82	14	20 52	32.1	62	129.711	22 45	06.98		508.59
15	19 04	58.3	69	143.435	27 06	16.43		143.87	15	20 54	41.8	73	129.366	22 36	38.39		514.81
16	19 07	21.8	04	143.238	27 03	52.56		152.87	16	20 56	51.2	39	129.019	22 28	03.58		520.96
17	19 09	45.0	42	143.035	27 01	19.69		161.85	17	20 59	00.2	58	128.674	22 19	22.62		527.04
18	19 12	08.0	77	142.826	26 58	37.84		170.78	18	21 01	08.9	32	128.327	22 10	35.58		533.05
19	19 14	30.9	03	142.611	26 55	47.06		179.66	19	21 03	17.2	59	127.981	22 01	42.53		538.98
20	19 16	53.5	14	142.392	26 52	47.40		188.50	20	21 05	25.2	40	127.634	21 52	43.55		544.85
21	19 19	15.9	06	142.167	26 49	38.90		197.29	21	21 07	32.8	74	127.289	21 43	38.70		550.65
22	19 21	38.0	73	141.937	26 46	21.61		206.05	22	21 09	40.1	63	126.944	21 34	28.05		556.37
23	19 24	00.0	10	141.701	-26 42	55.56	+	214.74	23	21 11	47.1	07	126.598	-21 25	11.68	+	562.03
February 7									February 9								
0	19 26	21.7	11	141.460	-26 39	20.82	+	223.40	0	21 13	53.7	05	126.254	-21 15	49.65	+	567.62
1	19 28	43.1	71	141.214	26 35	37.42	+	232.01	1	21 15	59.9	59	125.911	21 06	22.03	+	573.14
2	19 31	04.3	85	140.964	26 31	45.41		240.55	2	21 18	05.8	70	125.567	20 56	48.89		578.58
3	19 33	25.3	49	140.709	26 27	44.86		249.06	3	21 20	11.4	37	125.225	20 47	10.31		583.96
4	19 35	46.0	58	140.449	26 23	35.80		257.51	4	21 22	16.6	62	124.883	20 37	26.35		589.28
5	19 38	06.5	07	140.184	26 19	18.29		265.91	5	21 24	21.5	45	124.544	20 27	37.07		594.51
6	19 40	26.6	91	139.916	26 14	52.38		274.25	6	21 26	26.0	89	124.204	20 17	42.56		599.68
7	19 42	46.6	07	139.642	26 10	18.13		282.54	7	21 28	30.2	93	123.866	20 07	42.88		604.78
8	19 45	06.2	49	139.365	26 05	35.59		290.77	8	21 30	34.1	59	123.530	19 57	38.10		609.81
9	19 47	25.6	14	139.083	26 00	44.82		298.95	9	21 32	37.6	89	123.194	19 47	28.29		614.78
10	19 49	44.6	97	138.798	25 55	45.87		307.06	10	21 34	40.8	83	122.860	19 37	13.51		619.66
11	19 52	03.4	95	138.509	25 50	38.81		315.13	11	21 36	43.7	43	122.528	19 26	53.85		624.50
12	19 54	22.0	04	138.216	25 45	23.68		323.12	12	21 38	46.2	71	122.198	19 16	29.35		629.25
13	19 56	40.2	20	137.919	25 40	00.56		331.07	13	21 40	48.4	69	121.868	19 06	00.10		633.95
14	19 58	58.1	39	137.620	25 34	29.49		338.95	14	21 42	50.3	37	121.541	18 55	26.15		638.56
15	20 01	15.7	59	137.316	25 28	50.54		346.76	15	21 44	51.8	78	121.216	18 44	47.59		643.12
16	20 03	33.0	75	137.009	25 23	03.78		354.53	16	21 46	53.0	94	120.892	18 34	04.47		647.61
17	20 05	50.0	84	136.701	25 17	09.25		362.22	17	21 48	53.9	86	120.571	18 23	16.86		652.03
18	20 08	06.7	85	136.387	25 11	07.03		369.85	18	21 50	54.5	57	120.251	18 12	24.83		656.38
19	20 10	23.1	72	136.073	25 04	57.18		377.42	19	21 52	54.8	08	119.933	18 01	28.45		660.67
20	20 12	39.2	45	135.754	24 58	39.76		384.93	20	21 54	54.7	41	119.619	17 50	27.78		664.89
21	20 14	54.9	99	135.434	24 52	14.83		392.37	21	21 56	54.3	60	119.305	17 39	22.89		669.04
22	20 17	10.4	33	135.110	24 45	42.46		399.74	22	21 58	53.6	65	118.995	17 28	13.85		673.14
23	20 19	25.5	43	134.786	24 39	02.72	+	407.05	23	22 00	52.6	60	118.687	17 17	00.71	+	677.16
24	20 21	40.3	29		-24 32	15.67			24	22 02	51.3	47		-17 05	43.55		

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 10			February 12		
h	h m s	° ' "	h	h m s	° ' "
0	22 02 51.347	-17 05 43.55	0	23 32 43.808	-7 04 56.83
1	22 04 49.728	118.381	1	23 34 31.195	6 51 34.95
2	22 06 47.806	118.078	2	23 36 18.442	6 38 11.84
3	22 08 45.582	117.776	3	23 38 05.552	6 24 47.57
4	22 10 43.061	117.479	4	23 39 52.530	6 11 22.17
5	22 12 40.244	117.183	5	23 41 39.379	5 57 55.69
6	22 14 37.134	116.890	6	23 43 26.104	5 44 28.18
7	22 16 33.734	116.600	7	23 45 12.708	5 30 59.69
8	22 18 30.046	116.312	8	23 46 59.195	5 17 30.25
9	22 20 26.074	116.028	9	23 48 45.570	5 03 59.92
10	22 22 21.821	115.747	10	23 50 31.836	4 50 28.75
11	22 24 17.289	115.468	11	23 52 17.998	4 36 56.77
12	22 26 12.481	115.192	12	23 54 04.059	4 23 24.03
13	22 28 07.401	114.920	13	23 55 50.023	4 09 50.58
14	22 30 02.051	114.650	14	23 57 35.895	3 56 16.46
15	22 31 56.434	114.383	15	23 59 21.678	3 42 41.72
16	22 33 50.555	114.121	16	00 01 07.377	3 29 06.39
17	22 35 44.415	113.860	17	00 02 52.996	3 15 30.53
18	22 37 38.018	113.603	18	00 04 38.538	3 01 54.17
19	22 39 31.367	113.349	19	00 06 24.008	2 48 17.36
20	22 41 24.467	113.100	20	00 08 09.410	2 34 40.15
21	22 43 17.319	112.852	21	00 09 54.748	2 21 02.57
22	22 45 09.927	112.608	22	00 11 40.025	2 07 24.67
23	22 47 02.295	112.368	23	00 13 25.247	1 53 46.49
	112.131	+755.09		105.170	+818.41
February 11			February 13		
h	h m s	° ' "	h	h m s	° ' "
0	22 48 54.426	-12 17 27.79	0	01 15 10.417	-1 40 08.08
1	22 50 46.324	111.898	1	01 16 55.540	1 26 29.47
2	22 52 37.991	111.667	2	01 18 40.619	1 12 50.71
3	22 54 29.432	111.441	3	01 20 25.659	0 59 11.84
4	22 56 20.650	111.218	4	01 22 10.663	0 45 32.90
5	22 58 11.649	110.999	5	01 23 55.636	0 31 53.94
6	23 00 02.432	110.783	6	01 25 40.582	0 18 14.99
7	23 01 53.003	110.571	7	01 27 25.506	0 04 36.09
8	23 03 43.364	110.361	8	01 29 10.410	0 09 02.70
9	23 05 33.521	110.157	9	01 30 55.301	0 22 41.36
10	23 07 23.477	109.956	10	01 32 40.180	0 36 19.84
11	23 09 13.235	109.758	11	01 34 25.054	0 49 58.10
12	23 11 02.799	109.564	12	01 36 09.926	1 03 36.09
13	23 12 52.172	109.373	13	01 37 54.799	1 17 13.78
14	23 14 41.359	109.187	14	01 39 39.679	1 30 51.13
15	23 16 30.364	109.005	15	01 41 24.570	1 44 28.10
16	23 18 19.189	108.825	16	01 43 09.475	1 58 04.64
17	23 20 07.839	108.650	17	01 44 54.399	2 11 40.72
18	23 21 56.318	108.479	18	01 46 39.347	2 25 16.29
19	23 23 44.629	108.311	19	01 48 24.321	2 38 51.31
20	23 25 32.777	108.148	20	01 50 09.327	2 52 25.75
21	23 27 20.765	107.988	21	01 51 54.369	3 05 59.56
22	23 29 08.597	107.832	22	01 53 39.451	3 19 32.70
23	23 30 56.276	107.679	23	01 55 24.577	3 33 05.13
24	23 32 43.808	107.532	24	01 57 09.751	3 46 36.82
		-7 04 56.83			+811.69

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension		Apparent Declination		Hour	Apparent Right Ascension		Apparent Declination	
February 14					February 16				
h	h	m	s	° ' "	h	h	m	s	° ' "
0	0 57	09.751	105.227	+ 3 46 36.82	0	2 23	38.182	112.738	+14 07 42.73
1	0 58	54.978	105.284	4 00 07.72	1	2 25	30.920	112.997	14 19 45.90
2	1 00	40.262	105.344	4 13 37.79	2	2 27	23.917	113.260	14 31 46.12
3	1 02	25.606	105.410	4 27 06.98	3	2 29	17.177	113.526	14 43 43.33
4	1 04	11.016	105.480	4 40 35.27	4	2 31	10.703	113.798	14 55 37.47
5	1 05	56.496	105.553	4 54 02.61	5	2 33	04.501	114.073	15 07 28.51
6	1 07	42.049	105.632	5 07 28.95	6	2 34	58.574	114.352	15 19 16.37
7	1 09	27.681	105.713	5 20 54.27	7	2 36	52.926	114.634	15 31 01.02
8	1 11	13.394	105.800	5 34 18.51	8	2 38	47.560	114.921	15 42 42.40
9	1 12	59.194	105.891	5 47 41.63	9	2 40	42.481	115.212	15 54 20.45
10	1 14	45.085	105.986	6 01 03.61	10	2 42	37.693	115.506	16 05 55.13
11	1 16	31.071	106.085	6 14 24.38	11	2 44	33.199	115.805	16 17 26.36
12	1 18	17.156	106.189	6 27 43.92	12	2 46	29.004	116.106	16 28 54.11
13	1 20	03.345	106.296	6 41 02.18	13	2 48	25.110	116.412	16 40 18.30
14	1 21	49.641	106.409	6 54 19.12	14	2 50	21.522	116.721	16 51 38.90
15	1 23	36.050	106.525	7 07 34.70	15	2 52	18.243	117.035	17 02 55.83
16	1 25	22.575	106.645	7 20 48.88	16	2 54	15.278	117.351	17 14 09.05
17	1 27	09.220	106.770	7 34 01.61	17	2 56	12.629	117.672	17 25 18.49
18	1 28	55.990	106.899	7 47 12.86	18	2 58	10.301	117.995	17 36 24.10
19	1 30	42.889	107.033	8 00 22.58	19	3 00	08.296	118.323	17 47 25.81
20	1 32	29.922	107.170	8 13 30.72	20	3 02	06.619	118.654	17 58 23.58
21	1 34	17.092	107.312	8 26 37.26	21	3 04	05.273	118.988	18 09 17.33
22	1 36	04.404	107.458	8 39 42.14	22	3 06	04.261	119.326	18 20 07.01
23	1 37	51.862	107.608	+ 8 52 45.32	23	3 08	03.587	119.667	+18 30 52.55
February 15					February 17				
0	1 39	39.470	107.763	+ 9 05 46.76	0	3 10	03.254	120.012	+18 41 33.91
1	1 41	27.233	107.922	9 18 46.41	1	3 12	03.266	120.359	18 52 11.00
2	1 43	15.155	108.085	9 31 44.24	2	3 14	03.625	120.709	19 02 43.78
3	1 45	03.240	108.253	9 44 40.19	3	3 16	04.334	121.064	19 13 12.18
4	1 46	51.493	108.423	9 57 34.23	4	3 18	05.398	121.421	19 23 36.13
5	1 48	39.916	108.600	10 10 26.31	5	3 20	06.819	121.780	19 33 55.58
6	1 50	28.516	108.780	10 23 16.39	6	3 22	08.599	122.144	19 44 10.45
7	1 52	17.296	108.964	10 36 04.41	7	3 24	10.743	122.510	19 54 20.68
8	1 54	06.260	109.153	10 48 50.35	8	3 26	13.253	122.878	20 04 26.22
9	1 55	55.413	109.346	11 01 34.14	9	3 28	16.131	123.250	20 14 26.98
10	1 57	44.759	109.542	11 14 15.75	10	3 30	19.381	123.624	20 24 22.91
11	1 59	34.301	109.744	11 26 55.13	11	3 32	23.005	124.001	20 34 13.94
12	2 01	24.045	109.949	11 39 32.23	12	3 34	27.006	124.380	20 44 00.00
13	2 03	13.994	110.159	11 52 07.01	13	3 36	31.386	124.762	20 53 41.02
14	2 05	04.153	110.372	12 04 39.43	14	3 38	36.148	125.147	21 03 16.94
15	2 06	54.525	110.591	12 17 09.42	15	3 40	41.295	125.532	21 12 47.68
16	2 08	45.116	110.812	12 29 36.96	16	3 42	46.827	125.922	21 22 13.19
17	2 10	35.928	111.039	12 42 01.98	17	3 44	52.749	126.313	21 31 33.37
18	2 12	26.967	111.269	12 54 24.44	18	3 46	59.062	126.706	21 40 48.18
19	2 14	18.236	111.504	13 06 44.29	19	3 49	05.768	127.100	21 49 57.53
20	2 16	09.740	111.742	13 19 01.49	20	3 51	12.868	127.498	21 59 01.36
21	2 18	01.482	111.985	13 31 15.98	21	3 53	20.366	127.896	22 07 59.59
22	2 19	53.467	112.232	13 43 27.72	22	3 55	28.262	128.297	22 16 52.16
23	2 21	45.699	112.483	13 55 36.65	23	3 57	36.559	128.699	22 25 38.98
24	2 23	38.182		+14 07 42.73	24	3 59	45.258		+22 34 19.99

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 18			February 20		
0	3 59 45.258 ^s	+22 34 19.99 [°]	0	5 50 36.409 ^s	+27 12 28.96 [°]
1	4 01 54.360 ^s 129.102	22 42 55.12 [°] +515.13 [″]	1	5 53 04.123 ^s 147.714	27 14 52.48 [°] +143.52 [″]
2	4 04 03.867 ^s 129.507	22 51 24.28 [°] 509.16 [″]	2	5 55 32.148 ^s 148.025	27 17 06.47 [°] 133.99 [″]
3	4 06 13.781 ^s 129.914	22 59 47.41 [°] 503.13 [″]	3	5 58 00.479 ^s 148.331	27 19 10.87 [°] 124.40 [″]
4	4 08 24.101 ^s 130.320	23 08 04.44 [°] 497.03 [″]	4	6 00 29.110 ^s 148.631	27 21 05.62 [°] 114.75 [″]
5	4 10 34.830 ^s 130.729	23 16 15.28 [°] 490.84 [″]	5	6 02 58.034 ^s 148.924	27 22 50.67 [°] 105.05 [″]
6	4 12 45.969 ^s 131.139	23 24 19.86 [°] 484.58 [″]	6	6 05 27.247 ^s 149.213	27 24 25.94 [°] 95.27 [″]
7	4 14 57.518 ^s 131.549	23 32 18.11 [°] 478.25 [″]	7	6 07 56.740 ^s 149.493	27 25 51.39 [°] 85.45 [″]
8	4 17 09.477 ^s 131.959	23 40 09.96 [°] 471.85 [″]	8	6 10 26.509 ^s 149.769	27 27 06.95 [°] 75.56 [″]
9	4 19 21.849 ^s 132.372	23 47 55.31 [°] 465.35 [″]	9	6 12 56.546 ^s 150.037	27 28 12.57 [°] 65.62 [″]
10	4 21 34.632 ^s 132.783	23 55 34.11 [°] 458.80 [″]	10	6 15 26.844 ^s 150.298	27 29 08.20 [°] 55.63 [″]
11	4 23 47.828 ^s 133.196	24 03 06.28 [°] 452.17 [″]	11	6 17 57.398 ^s 150.554	27 29 53.78 [°] 45.58 [″]
12	4 26 01.436 ^s 133.608	24 10 31.73 [°] 445.45 [″]	12	6 20 28.200 ^s 150.802	27 30 29.26 [°] 35.48 [″]
13	4 28 15.457 ^s 134.021	24 17 50.39 [°] 438.66 [″]	13	6 22 59.243 ^s 151.043	27 30 54.59 [°] 25.33 [″]
14	4 30 29.891 ^s 134.434	24 25 02.18 [°] 431.79 [″]	14	6 25 30.519 ^s 151.276	27 31 09.72 [°] 15.13 [″]
15	4 32 44.738 ^s 134.847	24 32 07.03 [°] 424.85 [″]	15	6 28 02.023 ^s 151.504	27 31 14.60 [°] + 4.88 [″]
16	4 34 59.996 ^s 135.258	24 39 04.87 [°] 417.84 [″]	16	6 30 33.745 ^s 151.722	27 31 09.20 [°] - 5.40 [″]
17	4 37 15.667 ^s 135.671	24 45 55.60 [°] 410.73 [″]	17	6 33 05.680 ^s 151.935	27 30 53.46 [°] 15.74 [″]
18	4 39 31.749 ^s 136.082	24 52 39.15 [°] 403.55 [″]	18	6 35 37.818 ^s 152.138	27 30 27.35 [°] 26.11 [″]
19	4 41 48.241 ^s 136.492	24 59 15.46 [°] 396.31 [″]	19	6 38 10.154 ^s 152.336	27 29 50.81 [°] 36.54 [″]
20	4 44 05.143 ^s 136.902	25 05 44.43 [°] 388.97 [″]	20	6 40 42.678 ^s 152.524	27 29 03.82 [°] 46.99 [″]
21	4 46 22.454 ^s 137.311	25 12 05.99 [°] 381.56 [″]	21	6 43 15.383 ^s 152.705	27 28 06.34 [°] 57.48 [″]
22	4 48 40.172 ^s 137.718	25 18 20.07 [°] 374.08 [″]	22	6 45 48.262 ^s 152.879	27 26 58.32 [°] 68.02 [″]
23	4 50 58.296 ^s 138.124	+25 24 26.59 [°] 366.52 [″]	23	6 48 21.306 ^s 153.044	+27 25 39.74 [°] 78.58 [″]
	138.529	+358.87 [″]		153.201	- 89.17 [″]
February 19			February 21		
0	4 53 16.825 ^s 138.932	+25 30 25.46 [°]	0	6 50 54.507 ^s 153.350	+27 24 10.57 [°] - 99.80 [″]
1	4 55 35.757 ^s 139.334	25 36 16.62 [°] +351.16 [″]	1	6 53 27.857 ^s 153.492	27 22 30.77 [°] 110.45 [″]
2	4 57 55.091 ^s 139.733	25 41 59.98 [°] 343.36 [″]	2	6 56 01.349 ^s 153.624	27 20 40.32 [°] 121.13 [″]
3	5 00 14.824 ^s 140.130	25 47 35.47 [°] 335.49 [″]	3	6 58 34.973 ^s 153.749	27 18 39.19 [°] 131.84 [″]
4	5 02 34.954 ^s 140.526	25 53 03.00 [°] 327.53 [″]	4	7 01 08.722 ^s 153.865	27 16 27.35 [°] 142.56 [″]
5	5 04 55.480 ^s 140.918	25 58 22.52 [°] 319.52 [″]	5	7 03 42.587 ^s 153.974	27 14 04.79 [°] 153.31 [″]
6	5 07 16.398 ^s 141.308	26 03 33.93 [°] 303.23 [″]	6	7 06 16.561 ^s 154.073	27 11 31.48 [°] 164.07 [″]
7	5 09 37.706 ^s 141.696	26 08 37.16 [°] 294.97 [″]	7	7 08 50.634 ^s 154.165	27 08 47.41 [°] 174.86 [″]
8	5 11 59.402 ^s 142.081	26 13 32.13 [°] 286.65 [″]	8	7 11 24.799 ^s 154.248	27 05 52.55 [°] 185.65 [″]
9	5 14 21.483 ^s 142.462	26 18 18.78 [°] 278.24 [″]	9	7 13 59.047 ^s 154.323	27 02 46.90 [°] 196.45 [″]
10	5 16 43.945 ^s 142.841	26 22 57.02 [°] 269.76 [″]	10	7 16 33.370 ^s 154.389	26 59 30.45 [°] 207.28 [″]
11	5 19 06.786 ^s 143.216	26 27 26.78 [°] 261.20 [″]	11	7 19 07.759 ^s 154.448	26 56 03.17 [°] 218.10 [″]
12	5 21 30.002 ^s 143.587	26 31 47.98 [°] 252.58 [″]	12	7 21 42.207 ^s 154.497	26 52 25.07 [°] 228.94 [″]
13	5 23 53.589 ^s 143.956	26 36 00.56 [°] 243.88 [″]	13	7 24 16.704 ^s 154.539	26 48 36.13 [°] 239.77 [″]
14	5 26 17.545 ^s 144.319	26 40 04.44 [°] 235.10 [″]	14	7 26 51.243 ^s 154.571	26 44 36.36 [°] 250.60 [″]
15	5 28 41.864 ^s 144.680	26 43 59.54 [°] 226.25 [″]	15	7 29 25.814 ^s 154.597	26 40 25.76 [°] 261.45 [″]
16	5 31 06.544 ^s 145.035	26 47 45.79 [°] 217.34 [″]	16	7 32 00.411 ^s 154.614	26 36 04.31 [°] 272.27 [″]
17	5 33 31.579 ^s 145.387	26 51 23.13 [°] 208.35 [″]	17	7 34 35.025 ^s 154.622	26 31 32.04 [°] 283.11 [″]
18	5 35 56.966 ^s 145.734	26 54 51.48 [°] 199.29 [″]	18	7 37 09.647 ^s 154.615	26 26 48.93 [°] 293.93 [″]
19	5 38 22.700 ^s 146.077	26 58 10.77 [°] 190.17 [″]	19	7 39 44.269 ^s 154.615	26 16 50.26 [°] 304.74 [″]
20	5 40 48.777 ^s 146.414	27 01 20.94 [°] 180.97 [″]	20	7 42 18.884 ^s 154.599	26 11 34.72 [°] 315.54 [″]
21	5 43 15.191 ^s 146.747	27 04 21.91 [°] 171.70 [″]	21	7 44 53.483 ^s 154.575	26 06 08.39 [°] 326.33 [″]
22	5 45 41.938 ^s 147.074	27 07 13.61 [°] 162.37 [″]	22	7 47 28.058 ^s 154.544	26 00 31.29 [°] 337.10 [″]
23	5 48 09.012 ^s 147.397	27 09 55.98 [°] +152.98 [″]	23	7 50 02.602 ^s 154.504	+25 54 43.44 [°] -347.85 [″]
24	5 50 36.409 ^s		24	7 52 37.106 ^s	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 22			February 24		
0	7 52 37.106 ^s 154.457	+25 54 43.44 ["] -358.59	0	9 53 23.553 ^s 145.633	+18 00 17.46 ["] -810.11
1	7 55 11.563 ^s 154.402	25 48 44.85 ["] 369.30	1	9 55 49.186 ^s 145.377	17 46 47.35 ["] 817.47
2	7 57 45.965 ^s 154.340	25 42 35.55 ["] 379.99	2	9 58 14.563 ^s 145.120	17 33 09.88 ["] 824.74
3	8 00 20.305 ^s 154.270	25 36 15.56 ["] 390.64	3	10 00 39.683 ^s 144.863	17 19 25.14 ["] 831.88
4	8 02 54.575 ^s 154.193	25 29 44.92 ["] 401.27	4	10 03 04.546 ^s 144.606	17 05 33.26 ["] 838.94
5	8 05 28.768 ^s 154.109	25 23 03.65 ["] 411.88	5	10 05 29.152 ^s 144.350	16 51 34.32 ["] 845.87
6	8 08 02.877 ^s 154.017	25 16 11.77 ["] 422.44	6	10 07 53.502 ^s 144.094	16 37 28.45 ["] 852.70
7	8 10 36.894 ^s 153.918	25 09 09.33 ["] 432.97	7	10 10 17.596 ^s 143.838	16 23 15.75 ["] 859.41
8	8 13 10.812 ^s 153.813	25 01 56.36 ["] 443.46	8	10 12 41.434 ^s 143.583	16 08 56.34 ["] 866.02
9	8 15 44.625 ^s 153.701	24 54 32.90 ["] 453.91	9	10 15 05.017 ^s 143.328	15 54 30.32 ["] 872.51
10	8 18 18.326 ^s 153.581	24 46 58.99 ["] 464.33	10	10 17 28.345 ^s 143.075	15 39 57.81 ["] 878.90
11	8 20 51.907 ^s 153.456	24 39 14.66 ["] 474.69	11	10 19 51.420 ^s 142.823	15 25 18.91 ["] 885.15
12	8 23 25.363 ^s 153.325	24 31 19.97 ["] 485.01	12	10 22 14.243 ^s 142.571	15 10 33.76 ["] 891.31
13	8 25 58.688 ^s 153.186	24 23 14.96 ["] 495.28	13	10 24 36.814 ^s 142.321	14 55 42.45 ["] 897.34
14	8 28 31.874 ^s 153.041	24 14 59.68 ["] 505.51	14	10 26 59.135 ^s 142.073	14 40 45.11 ["] 903.27
15	8 31 04.915 ^s 152.891	24 06 34.17 ["] 515.68	15	10 29 21.208 ^s 141.826	14 25 41.84 ["] 909.06
16	8 33 37.806 ^s 152.736	23 57 58.49 ["] 525.79	16	10 31 43.034 ^s 141.581	14 10 32.78 ["] 914.76
17	8 36 10.542 ^s 152.573	23 49 12.70 ["] 535.85	17	10 34 04.615 ^s 141.337	13 55 18.02 ["] 920.32
18	8 38 43.115 ^s 152.406	23 40 16.85 ["] 545.85	18	10 36 25.952 ^s 141.095	13 39 57.70 ["] 925.78
19	8 41 15.521 ^s 152.234	23 31 11.00 ["] 555.80	19	10 38 47.047 ^s 140.856	13 24 31.92 ["] 931.11
20	8 43 47.755 ^s 152.055	23 21 55.20 ["] 565.67	20	10 41 07.903 ^s 140.618	13 09 00.81 ["] 936.32
21	8 46 19.810 ^s 151.873	23 12 29.53 ["] 575.48	21	10 43 28.521 ^s 140.383	12 53 24.49 ["] 941.42
22	8 48 51.683 ^s 151.685	23 02 54.05 ["] 585.24	22	10 45 48.904 ^s 140.151	12 37 43.07 ["] 946.39
23	8 51 23.368 ^s 151.492	+22 53 08.81 ["] -594.91	23	10 48 09.055 ^s 139.920	+12 21 56.68 ["] -951.25
February 23			February 25		
0	8 53 54.860 ^s 151.295	+22 43 13.90 ["] -604.53	0	10 50 28.975 ^s 139.692	+12 06 05.43 ["] -955.98
1	8 56 26.155 ^s 151.093	22 33 09.37 ["] 614.06	1	10 52 48.667 ^s 139.466	11 50 09.45 ["] 960.60
2	8 58 57.248 ^s 150.888	22 22 55.31 ["] 623.54	2	10 55 08.133 ^s 139.244	11 34 08.85 ["] 965.09
3	9 01 28.136 ^s 150.678	22 12 31.77 ["] 632.92	3	10 57 27.377 ^s 139.025	11 18 03.76 ["] 969.46
4	9 03 58.814 ^s 150.464	22 01 58.85 ["] 642.24	4	10 59 46.402 ^s 138.808	11 01 54.30 ["] 973.72
5	9 06 29.278 ^s 150.247	21 51 16.61 ["] 651.48	5	11 02 05.210 ^s 138.594	10 45 40.58 ["] 977.84
6	9 08 59.525 ^s 150.025	21 40 25.13 ["] 660.63	6	11 04 23.804 ^s 138.383	10 29 22.74 ["] 981.85
7	9 11 29.550 ^s 149.801	21 29 24.50 ["] 669.71	7	11 06 42.187 ^s 138.176	10 13 00.89 ["] 985.73
8	9 13 59.351 ^s 149.574	21 18 14.79 ["] 678.71	8	11 09 00.363 ^s 137.972	9 56 35.16 ["] 989.49
9	9 16 28.925 ^s 149.343	21 06 56.08 ["] 687.61	9	11 11 18.335 ^s 137.770	9 40 05.67 ["] 993.14
10	9 18 58.268 ^s 149.110	20 55 28.47 ["] 696.43	10	11 13 36.105 ^s 137.573	9 23 32.53 ["] 996.65
11	9 21 27.378 ^s 148.873	20 43 52.04 ["] 705.17	11	11 15 53.678 ^s 137.380	9 06 55.88 ["] 1000.04
12	9 23 56.251 ^s 148.634	20 32 06.87 ["] 713.81	12	11 18 11.058 ^s 137.188	8 50 15.84 ["] 1003.32
13	9 26 24.885 ^s 148.394	20 20 13.06 ["] 722.36	13	11 20 28.246 ^s 137.002	8 33 32.52 ["] 1006.47
14	9 28 53.279 ^s 148.150	20 08 10.70 ["] 730.83	14	11 22 45.248 ^s 136.819	8 16 46.05 ["] 1009.49
15	9 31 21.429 ^s 147.904	19 55 59.87 ["] 739.19	15	11 25 02.067 ^s 136.639	7 59 56.56 ["] 1012.40
16	9 33 49.333 ^s 147.658	19 43 40.68 ["] 747.47	16	11 27 18.706 ^s 136.464	7 43 04.16 ["] 1015.18
17	9 36 16.991 ^s 147.409	19 31 13.21 ["] 755.65	17	11 29 35.170 ^s 136.292	7 26 08.98 ["] 1017.84
18	9 38 44.400 ^s 147.158	19 18 37.56 ["] 763.73	18	11 31 51.462 ^s 136.124	7 09 11.14 ["] 1020.37
19	9 41 11.558 ^s 146.907	19 05 53.83 ["] 771.71	19	11 34 07.586 ^s 135.960	6 52 10.77 ["] 1022.79
20	9 43 38.465 ^s 146.653	18 53 02.12 ["] 779.60	20	11 36 23.546 ^s 135.801	6 35 07.98 ["] 1025.08
21	9 46 05.118 ^s 146.400	18 40 02.52 ["] 787.37	21	11 38 39.347 ^s 135.644	6 18 02.90 ["] 1027.25
22	9 48 31.518 ^s 146.145	18 26 55.15 ["] 795.06	22	11 40 54.991 ^s 135.494	6 00 55.65 ["] 1029.30
23	9 50 57.663 ^s 145.890	18 13 40.09 ["] -802.63	23	11 43 10.485 ^s 135.345	5 43 46.35 ["] -1031.22
24	9 53 23.553 ^s	+18 00 17.46 ["]	24	11 45 25.830 ^s	+ 5 26 35.13 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
February 26			February 28		
^h 0	^h 11 ^m 45 ^s 25.830 ^s 135.203	+ 5 26 35.13 ^s -1033.02	^h 0	^h 13 ^m 32 ^s 16.637 ^s 133.621	- 8 17 31.74 ^s -982.94
1	11 47 41.033 135.063	5 09 22.11 1034.71	1	13 34 30.258 133.696	8 33 54.68 979.24
2	11 49 56.096 134.929	4 52 07.40 1036.27	2	13 36 43.954 133.775	8 50 13.92 975.44
3	11 52 11.025 134.798	4 34 51.13 1037.70	3	13 38 57.729 133.858	9 06 29.36 971.53
4	11 54 25.823 134.672	4 17 33.43 1039.03	4	13 41 11.587 133.945	9 22 40.89 967.53
5	11 56 40.495 134.551	4 00 14.40 1040.22	5	13 43 25.532 134.035	9 38 48.42 963.43
6	11 58 55.046 134.434	3 42 54.18 1041.30	6	13 45 39.567 134.131	9 54 51.85 959.24
7	12 01 09.480 134.320	3 25 32.88 1042.26	7	13 47 53.698 134.228	10 10 51.09 954.94
8	12 03 23.800 134.213	3 08 10.62 1043.09	8	13 50 07.926 134.330	10 26 46.03 950.55
9	12 05 38.013 134.109	2 50 47.53 1043.82	9	13 52 22.256 134.436	10 42 36.58 946.07
10	12 07 52.122 134.009	2 33 23.71 1044.41	10	13 54 36.692 134.545	10 58 22.65 941.49
11	12 10 06.131 133.915	2 15 59.30 1044.89	11	13 56 51.237 134.657	11 14 04.14 936.81
12	12 12 20.046 133.824	1 58 34.41 1045.25	12	13 59 05.894 134.773	11 29 40.95 932.05
13	12 14 33.870 133.739	1 41 09.16 1045.49	13	14 01 20.667 134.893	12 00 40.19 927.19
14	12 16 47.609 133.658	1 23 43.67 1045.62	14	14 03 35.560 135.014	12 16 02.42 922.23
15	12 19 01.267 133.581	1 06 18.05 1045.63	15	14 05 50.574 135.141	12 31 19.62 917.20
16	12 21 14.848 133.510	0 48 52.42 1045.52	16	14 08 05.715 135.269	12 46 31.67 912.05
17	12 23 28.358 133.442	0 31 26.90 1045.29	17	14 10 20.984 135.402	13 01 38.51 906.84
18	12 25 41.800 133.380	+ 0 14 01.61 1044.95	18	14 12 36.386 135.536	13 16 40.03 901.52
19	12 27 55.180 133.322	- 0 03 23.34 1044.49	19	14 14 51.922 135.674	13 31 36.14 896.11
20	12 30 08.502 133.269	0 20 47.83 1043.91	20	14 17 07.596 135.815	13 46 26.76 889.62
21	12 32 21.771 133.220	0 38 11.74 1043.23	21	14 19 23.411 135.958	14 01 11.81 885.05
22	12 34 34.991 133.176	0 55 34.97 1042.42	22	14 21 39.369 136.104	14 15 51.19 879.38
23	12 36 48.167 133.137	- 1 12 57.39 1041.51	23	14 23 55.473 136.253	- 14 30 24.81 873.62
February 27			March 1		
0	12 39 01.304 133.102	- 1 30 18.90 1040.48	0	14 26 11.726 136.405	- 14 44 52.60 867.79
1	12 41 14.406 133.072	1 47 39.38 1039.33	1	14 28 28.131 136.558	14 59 14.46 861.86
2	12 43 27.478 133.046	2 04 58.71 1038.07	2	14 30 44.689 136.714	15 13 30.31 855.85
3	12 45 40.524 133.025	2 22 16.78 1036.71	3	14 33 01.403 136.872	15 27 40.08 849.77
4	12 47 53.549 133.010	2 39 33.49 1035.22	4	14 35 18.275 137.033	15 41 43.67 843.59
5	12 50 06.559 132.997	2 56 48.71 1033.63	5	14 37 35.308 137.196	15 55 41.00 837.33
6	12 52 19.556 132.991	3 14 02.34 1031.93	6	14 39 52.504 137.359	16 09 31.99 830.99
7	12 54 32.547 132.987	3 31 14.27 1030.12	7	14 42 09.863 137.527	16 23 16.57 824.58
8	12 56 45.534 132.990	3 48 24.39 1028.19	8	14 44 27.390 137.694	16 36 54.64 818.07
9	12 58 58.524 132.997	4 05 32.58 1026.16	9	14 46 45.084 137.865	16 50 26.14 811.50
10	13 01 11.521 133.007	4 22 38.74 1024.02	10	14 49 02.949 138.036	17 03 50.98 804.84
11	13 03 24.528 133.023	4 39 42.76 1021.77	11	14 51 20.985 138.208	17 17 09.09 798.11
12	13 05 37.551 133.043	4 56 44.53 1019.42	12	14 53 39.193 138.383	17 30 20.38 791.29
13	13 07 50.594 133.068	5 13 43.95 1016.95	13	14 55 57.576 138.559	17 43 24.79 784.41
14	13 10 03.662 133.096	5 30 40.90 1014.38	14	14 58 16.135 138.736	17 56 22.23 777.44
15	13 12 16.758 133.130	5 47 35.28 1011.70	15	15 00 34.871 138.913	18 09 12.63 770.40
16	13 14 29.888 133.167	6 04 26.98 1008.92	16	15 02 53.784 139.092	18 21 55.92 763.29
17	13 16 43.055 133.209	6 21 15.90 1006.04	17	15 05 12.876 139.272	18 34 32.02 756.10
18	13 18 56.264 133.256	6 38 01.94 1003.04	18	15 07 32.148 139.452	18 47 00.86 748.84
19	13 21 09.520 133.305	6 54 44.98 999.95	19	15 09 51.600 139.634	18 59 22.38 741.52
20	13 23 22.825 133.361	7 11 24.93 996.76	20	15 12 11.234 139.814	19 11 36.49 734.11
21	13 25 36.186 133.419	7 28 01.69 993.45	21	15 14 31.048 139.997	19 23 43.13 726.64
22	13 27 49.605 133.483	7 44 35.14 990.05	22	15 16 51.045 140.179	19 35 42.22 719.09
23	13 30 03.088 133.549	8 01 05.19 986.55	23	15 19 11.224 140.361	- 19 47 33.71 711.49
24	13 32 16.637 133.597	- 8 17 31.74 983.05	24	15 21 31.585 140.543	

Hour	Apparent Right Ascension			Apparent Declination	Hour	Apparent Right Ascension			Apparent Declination
March 2					March 4				
^h 0	^h 15	^m 21	^s 31	[°] 58.5	^h 0	^h 17	^m 16	^s 55	[°] 13.6
1	15	23	52	140.543	1	17	19	22	146.892
2	15	26	12	140.726	2	17	21	48	146.927
3	15	28	33	140.907	3	17	24	15	146.955
4	15	30	54	141.090	4	17	26	42	146.978
5	15	33	16	141.270	5	17	29	09	146.995
6	15	35	37	141.451	6	17	31	36	147.006
7	15	37	59	141.632	7	17	34	03	147.012
8	15	40	21	141.810	8	17	36	30	147.011
9	15	42	43	141.988	9	17	38	57	147.004
10	15	45	05	142.166	10	17	41	24	146.992
11	15	47	27	142.342	11	17	43	51	146.973
12	15	49	50	142.516	12	17	46	18	146.948
13	15	52	12	142.689	13	17	48	45	146.918
14	15	54	35	142.860	14	17	51	12	146.881
15	15	56	58	143.030	15	17	53	39	146.837
16	15	59	21	143.199	16	17	56	06	146.788
17	16	01	45	143.364	17	17	58	32	146.732
18	16	04	08	143.527	18	18	00	59	146.671
19	16	06	32	143.690	19	18	03	26	146.603
20	16	08	56	143.848	20	18	05	52	146.528
21	16	11	20	144.005	21	18	08	19	146.448
22	16	13	44	144.160	22	18	10	45	146.361
23	16	16	08	144.310	23	18	13	11	146.268
				144.459					146.169
March 3					March 5				
0	16	18	33	144.605	0	18	15	38	146.063
1	16	20	57	144.746	1	18	18	04	145.953
2	16	23	22	144.886	2	18	20	30	145.834
3	16	25	47	145.021	3	18	22	55	145.711
4	16	28	12	145.154	4	18	25	21	145.581
5	16	30	37	145.282	5	18	27	47	145.444
6	16	33	02	145.407	6	18	30	12	145.304
7	16	35	28	145.528	7	18	32	37	145.155
8	16	37	53	145.645	8	18	35	03	145.001
9	16	40	19	145.758	9	18	37	28	144.842
10	16	42	45	145.867	10	18	39	52	144.676
11	16	45	11	145.971	11	18	42	17	144.505
12	16	47	37	146.071	12	18	44	42	144.329
13	16	50	03	146.167	13	18	47	06	144.145
14	16	52	29	146.258	14	18	49	30	143.958
15	16	54	55	146.344	15	18	51	54	143.764
16	16	57	21	146.425	16	18	54	18	143.565
17	16	59	48	146.502	17	18	56	41	143.360
18	17	02	14	146.573	18	18			

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 6			March 8		
h	h m s	° ' "	h	h m s	° ' "
0	19 13 20.807 ^s	-27 08 13.15 ["]	0	21 01 13.899 ^s	-22 16 20.06 ["]
1	19 15 42.594 ^s	141.787	1	21 03 20.745 ^s	126.846
2	19 18 04.137 ^s	141.543	2	21 05 27.253 ^s	126.508
3	19 20 25.432 ^s	141.295	3	21 07 33.424 ^s	126.171
4	19 22 46.474 ^s	141.042	4	21 09 39.259 ^s	125.835
5	19 25 07.258 ^s	140.784	5	21 11 44.758 ^s	125.499
6	19 27 27.780 ^s	140.522	6	21 13 49.922 ^s	125.164
7	19 29 48.037 ^s	140.257	7	21 15 54.752 ^s	124.830
8	19 32 08.024 ^s	139.987	8	21 17 59.249 ^s	124.497
9	19 34 27.737 ^s	139.713	9	21 20 03.415 ^s	124.166
10	19 36 47.173 ^s	139.436	10	21 22 07.250 ^s	123.835
11	19 39 06.328 ^s	139.155	11	21 24 10.756 ^s	123.506
12	19 41 25.197 ^s	138.869	12	21 26 13.934 ^s	123.178
13	19 43 43.779 ^s	138.582	13	21 28 16.786 ^s	122.852
14	19 46 02.068 ^s	138.289	14	21 30 19.313 ^s	122.527
15	19 48 20.063 ^s	137.995	15	21 32 21.517 ^s	122.204
16	19 50 37.759 ^s	137.696	16	21 34 23.399 ^s	121.882
17	19 52 55.155 ^s	137.396	17	21 36 24.962 ^s	121.563
18	19 55 12.246 ^s	137.091	18	21 38 26.206 ^s	121.244
19	19 57 29.031 ^s	136.785	19	21 40 27.134 ^s	120.928
20	19 59 45.506 ^s	136.475	20	21 42 27.748 ^s	120.614
21	20 02 01.670 ^s	136.164	21	21 44 28.050 ^s	120.302
22	20 04 17.518 ^s	135.848	22	21 46 28.042 ^s	119.992
23	20 06 33.050 ^s	135.532	23	21 48 27.725 ^s	119.683
	135.213	-25 24 04.42 ["]		119.378	-18 28 57.35 ["]
		+367.03			+651.71
March 7			March 9		
h	h m s	° ' "	h	h m s	° ' "
0	20 08 48.263 ^s	-25 17 57.39 ["]	0	21 50 27.103 ^s	-18 18 05.64 ["]
1	20 11 03.155 ^s	134.892	1	21 52 26.176 ^s	119.073
2	20 13 17.723 ^s	134.568	2	21 54 24.949 ^s	118.773
3	20 15 31.967 ^s	134.244	3	21 56 23.422 ^s	118.473
4	20 17 45.884 ^s	133.917	4	21 58 21.598 ^s	118.176
5	20 19 59.472 ^s	133.588	5	22 00 19.480 ^s	117.882
6	20 22 12.731 ^s	133.259	6	22 02 17.071 ^s	117.591
7	20 24 25.658 ^s	132.927	7	22 04 14.372 ^s	117.301
8	20 26 38.253 ^s	132.595	8	22 06 11.386 ^s	117.014
9	20 28 50.514 ^s	132.261	9	22 08 08.116 ^s	116.730
10	20 31 02.440 ^s	131.926	10	22 10 04.565 ^s	116.449
11	20 33 14.031 ^s	131.591	11	22 12 00.735 ^s	116.170
12	20 35 25.284 ^s	131.253	12	22 13 56.630 ^s	115.895
13	20 37 36.200 ^s	130.916	13	22 15 52.251 ^s	115.621
14	20 39 46.779 ^s	130.579	14	22 17 47.601 ^s	115.350
15	20 41 57.018 ^s	130.239	15	22 19 42.684 ^s	115.083
16	20 44 06.919 ^s	129.901	16	22 21 37.503 ^s	114.819
17	20 46 16.480 ^s	129.561	17	22 23 32.060 ^s	114.557
18	20 48 25.701 ^s	129.221	18	22 25 26.359 ^s	114.299
19	20 50 34.583 ^s	128.882	19	22 27 20.401 ^s	114.042
20	20 52 43.125 ^s	128.542	20	22 29 14.192 ^s	113.791
21	20 54 51.328 ^s	128.203	21	22 31 07.732 ^s	113.540
22	20 56 59.190 ^s	127.862	22	22 33 01.027 ^s	113.295
23	20 59 06.714 ^s	127.524	23	22 34 54.078 ^s	113.051
24	21 01 13.899 ^s	127.185	24	22 36 46.889 ^s	112.811
		-22 16 20.06 ["]			-13 37 59.24 ["]
		+528.16			+739.48

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
March 10									March 12										
h	h	m	s	°	'	°	'	°	h	h	m	s	°	'	°	'	°		
0	22	36	46.889	112.574	-13	37	59.24	+742.41	0	0	03	26.640	105.319	-3	05	11.24	+822.11		
1	22	38	39.463	112.340	13	25	36.83	745.28	1	0	05	11.959	105.258	2	51	29.13	822.58		
2	22	40	31.803	112.110	13	13	11.55	748.11	2	0	06	57.217	105.202	2	37	46.55	823.01		
3	22	42	23.913	111.883	13	00	43.44	750.86	3	0	08	42.419	105.148	2	24	03.54	823.47		
4	22	44	15.796	111.659	12	48	12.58	753.58	4	0	10	27.567	105.099	2	10	20.13	823.75		
5	22	46	07.455	111.438	12	35	39.00	756.23	5	0	12	12.666	105.054	1	56	36.38	824.04		
6	22	47	58.893	111.221	12	23	02.77	758.83	6	0	13	57.720	105.012	1	42	52.34	824.31		
7	22	49	50.114	111.008	12	10	23.94	761.38	7	0	15	42.732	104.974	1	29	08.03	824.51		
8	22	51	41.122	110.797	11	57	42.56	763.87	8	0	17	27.706	104.940	1	15	23.52	824.67		
9	22	53	31.919	110.589	11	44	58.69	766.30	9	0	19	12.646	104.910	1	01	38.85	824.80		
10	22	55	22.508	110.387	11	32	12.39	768.69	10	0	20	57.556	104.884	0	47	54.05	824.87		
11	22	57	12.895	110.185	11	19	23.70	771.02	11	0	22	42.440	104.862	0	34	09.18	824.90		
12	22	59	03.080	109.990	11	06	32.68	773.30	12	0	24	27.302	104.842	0	20	24.28	824.89		
13	23	00	53.070	109.796	10	53	39.38	775.53	13	0	26	12.144	104.828	-	0	06	39.39	824.83	
14	23	02	42.866	109.606	10	40	43.85	777.70	14	0	27	56.972	104.817	+	0	07	05.44	824.73	
15	23	04	32.472	109.420	10	27	46.15	779.82	15	0	29	41.789	104.810	0	20	50.17	824.58		
16	23	06	21.892	109.237	10	14	46.33	781.90	16	0	31	26.599	104.807	0	34	34.75	824.40		
17	23	08	11.129	109.058	10	01	44.43	783.91	17	0	33	11.406	104.807	0	48	19.15	824.16		
18	23	10	00.187	108.882	9	48	40.52	785.88	18	0	34	56.213	104.812	1	02	03.31	823.88		
19	23	11	49.069	108.711	9	35	34.64	787.79	19	0	36	41.025	104.820	1	15	47.19	823.56		
20	23	13	37.780	108.541	9	22	26.85	789.66	20	0	38	25.845	104.832	1	29	30.75	823.20		
21	23	15	26.321	108.377	9	09	17.19	791.47	21	0	40	10.677	104.848	1	43	13.95	822.79		
22	23	17	14.698	108.216	8	56	05.72	793.24	22	0	41	55.525	104.867	1	56	56.74	822.33		
23	23	19	02.914	108.058	-	8	42	52.48	+794.95	23	0	43	40.392	104.892	+	2	10	39.07	+821.84
March 11									March 13										
0	23	20	50.972	107.904	-	8	29	37.53	+796.61	0	0	45	25.284	104.919	+	2	24	20.91	+821.29
1	23	22	38.876	107.754	8	16	20.92	798.23	1	0	47	10.203	104.950	2	38	02.20	820.71		
2	23	24	26.630	107.606	8	03	02.69	799.80	2	0	48	55.153	104.985	2	51	42.91	820.09		
3	23	26	14.236	107.464	7	49	42.89	801.30	3	0	50	40.138	105.025	3	05	23.00	819.41		
4	23	28	01.700	107.324	7	36	21.59	802.78	4	0	52	25.163	105.067	3	19	02.41	818.69		
5	23	29	49.024	107.189	7	22	58.81	804.19	5	0	54	10.230	105.115	3	32	41.10	817.94		
6	23	31	36.213	107.057	7	09	34.62	805.57	6	0	55	55.345	105.164	3	46	19.04	817.13		
7	23	33	23.270	106.928	6	56	09.05	806.88	7	0	57	40.509	105.220	3	59	56.17	816.29		
8	23	35	10.198	106.804	6	42	42.17	808.15	8	0	59	25.729	105.278	4	13	32.46	815.39		
9	23	36	57.002	106.682	6	29	14.02	809.38	9	1	01	11.007	105.340	4	27	07.85	814.46		
10	23	38	43.684	106.566	6	15	44.64	810.56	10	1	02	56.347	105.406	4	40	42.31	813.48		
11	23	40	30.250	106.452	6	02	14.08	811.68	11	1	04	41.753	105.476	4	54	15.79	812.46		
12	23	42	16.702	106.342	5	48	42.40	812.77	12	1	06	27.229	105.550	5	07	48.25	811.39		
13	23	44	03.044	106.236	5	35	09.63	813.80	13	1	08	12.779	105.627	5	21	19.64	810.29		
14	23	45	49.280	106.134	5	21	35.83	814.79	14	1	09	58.406	105.709	5	34	49.93	809.12		
15	23	47	35.414	106.036	5	08	01.04	815.72	15	1	11	44.115	105.794	5	48	19.05	807.93		
16	23	49	21.450	105.940	4	54	25.32	816.62	16	1	13	29.909	105.884	6	01	46.98	806.69		
17	23	51	07.390	105.850	4	40	48.70	817.47	17	1	15	15.793	105.976	6	15	13.67	805.39		
18	23	52	53.240	105.763	4	27	11.23	818.27	18	1	17	01.769	106.073	6	28	39.06	804.07		
19	23	54	39.003	105.679	4	13	32.96	819.02	19	1	18	47.842	106.175	6	42	03.13	802.69		
20	23	56	24.682	105.599	3	59	53.94	819.73	20	1	20	34.017	106.278	6	55	25.82	801.27		
21	23	58	10.281	105.524	3	46	14.21	820.39	21	1	22	20.295	106.387	7	08	47.09	799.80		
22	23	59	55.805	105.452	3	32	33.82	821.01	22	1	24	06.682	106.499	7	22	06.89	798.30		
23	0	01	41.257	105.383	3	18	52.81	+821.57	23	1	25	53.181	106.616	7	35	25.19	+796.74		
24	0	03	26.640		-	3	05	11.24		24	1	27	39.797		+	7	48	41.93	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 14			March 16		
h	h m s	° ' " 93	h	h m s	° ' " 24
0	1 27 39.797 106.735	+ 7 48 41.93 +795.14	0	2 56 27.135 116.819	+17 40 17.24 +661.96
1	1 29 26.532 106.859	8 01 57.07 793.49	1	2 58 23.954 117.111	17 51 19.20 657.91
2	1 31 13.391 106.986	8 15 10.56 791.81	2	3 00 21.065 117.408	18 02 17.11 653.80
3	1 33 00.377 107.118	8 28 22.37 790.06	3	3 02 18.473 117.707	18 13 10.91 649.65
4	1 34 47.495 107.253	8 41 32.43 788.29	4	3 04 16.180 118.010	18 24 00.56 645.42
5	1 36 34.748 107.392	8 54 40.72 786.46	5	3 06 14.190 118.314	18 34 45.98 641.15
6	1 38 22.140 107.535	9 07 47.18 784.59	6	3 08 12.504 118.622	18 45 27.13 636.82
7	1 40 09.675 107.681	9 20 51.77 782.67	7	3 10 11.126 118.933	18 56 03.95 632.42
8	1 41 57.356 107.832	9 33 54.44 780.71	8	3 12 10.059 119.245	19 06 36.37 627.97
9	1 43 45.188 107.986	9 46 55.15 778.70	9	3 14 09.304 119.561	19 17 04.34 623.47
10	1 45 33.174 108.143	9 59 53.85 776.64	10	3 16 08.865 119.880	19 27 27.81 618.89
11	1 47 21.317 108.306	10 12 50.49 774.53	11	3 18 08.745 120.200	19 37 46.70 614.26
12	1 49 09.623 108.470	10 25 45.02 772.39	12	3 20 08.945 120.524	19 48 00.96 609.58
13	1 50 58.093 108.640	10 38 37.41 770.19	13	3 22 09.469 120.849	19 58 10.54 604.82
14	1 52 46.733 108.813	10 51 27.60 767.94	14	3 24 10.318 121.177	20 08 15.36 600.02
15	1 54 35.546 108.990	11 04 15.54 765.66	15	3 26 11.495 121.508	20 18 15.38 595.14
16	1 56 24.536 109.170	11 17 01.20 763.31	16	3 28 13.003 121.840	20 28 10.52 590.21
17	1 58 13.706 109.354	11 29 44.51 760.93	17	3 30 14.843 122.175	20 38 00.73 585.22
18	2 00 03.060 109.542	11 42 25.44 758.49	18	3 32 17.018 122.511	20 47 45.95 580.17
19	2 01 52.602 109.734	11 55 03.93 756.02	19	3 34 19.529 122.851	20 57 26.12 575.04
20	2 03 42.336 109.928	12 07 39.95 753.48	20	3 36 22.380 123.191	21 07 01.16 569.87
21	2 05 32.264 110.128	12 20 13.43 750.90	21	3 38 25.571 123.535	21 16 31.03 564.63
22	2 07 22.392 110.330	12 32 44.33 748.27	22	3 40 29.106 123.878	21 25 55.66 559.32
23	2 09 12.722 110.536	+12 45 12.60 +745.59	23	3 42 32.984 124.225	+21 35 14.98 +553.95
March 15			March 17		
h	h m s	° ' " 19	h	h m s	° ' " 93
0	2 11 03.258 110.746	+12 57 38.19 +742.87	0	3 44 37.209 124.573	+21 44 28.93 +548.52
1	2 12 54.004 110.960	13 10 01.06 740.09	1	3 46 41.782 124.923	21 53 37.45 543.02
2	2 14 44.964 111.176	13 22 21.15 737.27	2	3 48 46.705 125.274	22 02 40.47 537.47
3	2 16 36.140 111.397	13 34 38.42 734.38	3	3 50 51.979 125.626	22 11 37.94 531.84
4	2 18 27.537 111.622	13 46 52.80 731.47	4	3 52 57.605 125.980	22 20 29.78 526.15
5	2 20 19.159 111.849	13 59 04.27 728.48	5	3 55 03.585 126.335	22 29 15.93 520.40
6	2 22 11.008 112.080	14 11 12.75 725.46	6	3 57 09.920 126.692	22 37 56.33 514.58
7	2 24 03.088 112.315	14 23 18.21 722.38	7	3 59 16.612 127.050	22 46 30.91 508.70
8	2 25 55.403 112.553	14 35 20.59 719.25	8	4 01 23.662 127.408	22 54 59.61 502.75
9	2 27 47.956 112.795	14 47 19.84 716.07	9	4 03 31.070 127.767	23 03 22.36 496.74
10	2 29 40.751 113.039	14 59 15.91 712.84	10	4 05 38.837 128.128	23 11 39.10 490.66
11	2 31 33.790 113.289	15 11 08.75 709.55	11	4 07 46.965 128.489	23 19 49.76 484.51
12	2 33 27.079 113.540	15 22 58.30 706.21	12	4 09 55.454 128.850	23 27 54.27 478.30
13	2 35 20.619 113.796	15 34 44.51 702.82	13	4 12 04.304 129.213	23 35 52.57 472.02
14	2 37 14.415 114.054	15 46 27.33 699.38	14	4 14 13.517 129.576	23 43 44.59 465.68
15	2 39 08.469 114.317	15 58 06.71 695.88	15	4 16 23.093 129.938	23 51 30.27 459.27
16	2 41 02.786 114.581	16 09 42.59 692.33	16	4 18 33.031 130.302	23 59 09.54 452.79
17	2 42 57.367 114.850	16 21 14.92 688.72	17	4 20 43.333 130.666	24 06 42.33 446.25
18	2 44 52.217 115.122	16 32 43.64 685.07	18	4 22 53.999 131.029	24 14 08.58 439.64
19	2 46 47.339 115.397	16 44 08.71 681.35	19	4 25 05.028 131.392	24 21 28.22 432.96
20	2 48 42.736 115.675	16 55 30.06 677.59	20	4 27 16.420 131.756	24 28 41.18 426.22
21	2 50 38.411 115.956	17 06 47.65 673.76	21	4 29 28.176 132.119	24 35 47.40 419.41
22	2 52 34.367 116.240	17 18 01.41 669.88	22	4 31 40.295 132.481	24 42 46.81 412.52
23	2 54 30.607 116.528	17 29 11.29 +665.95	23	4 33 52.776 132.843	24 49 39.33 +405.59
24	2 56 27.135	+17 40 17.24	24	4 36 05.619	+24 56 24.92

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 18			March 20		
h	h m s	° ' "	h	h m s	° ' "
0	4 36 05.619 ^s	+24 56 24.92 ^s	0	6 28 47.502 ^s	+27 43 47.74 ^s
1	4 38 18.824 ^s	25 03 03.49 ^s	1	6 31 14.927 ^s	27 43 36.82 ^s
2	4 40 32.389 ^s	25 09 34.98 ^s	2	6 33 42.535 ^s	27 43 16.10 ^s
3	4 42 46.315 ^s	25 15 59.33 ^s	3	6 36 10.320 ^s	27 42 45.54 ^s
4	4 45 00.599 ^s	25 22 16.47 ^s	4	6 38 38.276 ^s	27 42 05.11 ^s
5	4 47 15.241 ^s	25 28 26.33 ^s	5	6 41 06.397 ^s	27 41 14.78 ^s
6	4 49 30.239 ^s	25 34 28.84 ^s	6	6 43 34.675 ^s	27 40 14.52 ^s
7	4 51 45.593 ^s	25 40 23.94 ^s	7	6 46 03.104 ^s	27 39 04.29 ^s
8	4 54 01.300 ^s	25 46 11.56 ^s	8	6 48 31.679 ^s	27 37 44.07 ^s
9	4 56 17.360 ^s	25 51 51.64 ^s	9	6 51 00.391 ^s	27 36 13.82 ^s
10	4 58 33.770 ^s	25 57 24.11 ^s	10	6 53 29.236 ^s	27 34 33.52 ^s
11	5 00 50.529 ^s	26 02 48.90 ^s	11	6 55 58.205 ^s	27 32 43.16 ^s
12	5 03 07.635 ^s	26 08 05.95 ^s	12	6 58 27.294 ^s	27 30 42.69 ^s
13	5 05 25.085 ^s	26 13 15.19 ^s	13	7 00 56.494 ^s	27 28 32.11 ^s
14	5 07 42.878 ^s	26 18 16.57 ^s	14	7 03 25.799 ^s	27 26 11.38 ^s
15	5 10 01.010 ^s	26 23 10.01 ^s	15	7 05 55.202 ^s	27 23 40.50 ^s
16	5 12 19.480 ^s	26 27 55.44 ^s	16	7 08 24.697 ^s	27 20 59.44 ^s
17	5 14 38.286 ^s	26 32 32.81 ^s	17	7 10 54.277 ^s	27 18 08.19 ^s
18	5 16 57.423 ^s	26 37 02.06 ^s	18	7 13 23.935 ^s	27 15 06.74 ^s
19	5 19 16.890 ^s	26 41 23.11 ^s	19	7 15 53.665 ^s	27 11 55.06 ^s
20	5 21 36.684 ^s	26 45 35.91 ^s	20	7 18 23.459 ^s	27 08 33.16 ^s
21	5 23 56.800 ^s	26 49 40.40 ^s	21	7 20 53.311 ^s	27 05 01.02 ^s
22	5 26 17.237 ^s	26 53 36.50 ^s	22	7 23 23.215 ^s	27 01 18.63 ^s
23	5 28 37.991 ^s	+26 57 24.17 ^s	23	7 25 53.163 ^s	+26 57 25.99 ^s
	141.067	+219.17		149.986	-242.90
March 19			March 21		
0	5 30 59.058 ^s	+27 01 03.34 ^s	0	7 28 23.149 ^s	+26 53 23.09 ^s
1	5 33 20.434 ^s	27 04 33.95 ^s	1	7 30 53.166 ^s	26 49 09.93 ^s
2	5 35 42.117 ^s	27 07 55.94 ^s	2	7 33 23.208 ^s	26 44 46.50 ^s
3	5 38 04.102 ^s	27 11 09.25 ^s	3	7 35 53.268 ^s	26 40 12.82 ^s
4	5 40 26.384 ^s	27 14 13.82 ^s	4	7 38 23.340 ^s	26 35 28.87 ^s
5	5 42 48.961 ^s	27 17 09.60 ^s	5	7 40 53.417 ^s	26 30 34.67 ^s
6	5 45 11.828 ^s	27 19 56.53 ^s	6	7 43 23.493 ^s	26 25 30.22 ^s
7	5 47 34.980 ^s	27 22 34.55 ^s	7	7 45 53.561 ^s	26 20 15.53 ^s
8	5 49 58.413 ^s	27 25 03.61 ^s	8	7 48 23.615 ^s	26 14 50.60 ^s
9	5 52 22.122 ^s	27 27 23.65 ^s	9	7 50 53.648 ^s	26 09 15.44 ^s
10	5 54 46.104 ^s	27 29 34.62 ^s	10	7 53 23.656 ^s	26 03 30.08 ^s
11	5 57 10.352 ^s	27 31 36.47 ^s	11	7 55 53.630 ^s	25 57 34.51 ^s
12	5 59 34.862 ^s	27 33 29.14 ^s	12	7 58 23.567 ^s	25 51 28.76 ^s
13	6 01 59.630 ^s	27 35 12.58 ^s	13	8 00 53.458 ^s	25 45 12.85 ^s
14	6 04 24.649 ^s	27 36 46.74 ^s	14	8 03 23.300 ^s	25 38 46.79 ^s
15	6 06 49.915 ^s	27 38 11.58 ^s	15	8 05 53.085 ^s	25 32 10.60 ^s
16	6 09 15.422 ^s	27 39 27.04 ^s	16	8 08 22.808 ^s	25 25 24.31 ^s
17	6 11 41.166 ^s	27 40 33.08 ^s	17	8 10 52.464 ^s	25 18 27.94 ^s
18	6 14 07.140 ^s	27 41 29.64 ^s	18	8 13 22.047 ^s	25 11 21.51 ^s
19	6 16 33.339 ^s	27 42 16.70 ^s	19	8 15 51.552 ^s	25 04 05.06 ^s
20	6 18 59.756 ^s	27 42 54.19 ^s	20	8 18 20.973 ^s	24 56 38.61 ^s
21	6 21 26.387 ^s	27 43 22.08 ^s	21	8 20 50.305 ^s	24 49 02.20 ^s
22	6 23 53.226 ^s	27 43 40.33 ^s	22	8 23 19.543 ^s	24 41 15.85 ^s
23	6 26 20.266 ^s	27 43 48.90 ^s	23	8 25 48.682 ^s	24 33 19.60 ^s
24	6 28 47.502 ^s	+27 43 47.74 ^s	24	8 28 17.717 ^s	+24 25 13.48 ^s
	147.236	-1.16		149.935	-486.12

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 22			March 24		
0	8 28 17.717 ^{h m s}	+24 25 13.48 ^{° ' "}	0	10 24 26.312 ^{h m s}	+15 01 02.84 ^{° ' "}
1	8 30 46.643 ^s	148.926	1	10 26 47.026 ^s	140.714
2	8 33 15.457 ^s	148.814	2	10 29 07.560 ^s	140.534
3	8 35 44.153 ^s	148.696	3	10 31 27.917 ^s	140.357
4	8 38 12.726 ^s	148.573	4	10 33 48.099 ^s	140.182
5	8 40 41.173 ^s	148.447	5	10 36 08.106 ^s	140.007
6	8 43 09.490 ^s	148.317	6	10 38 27.942 ^s	139.836
7	8 45 37.672 ^s	148.182	7	10 40 47.608 ^s	139.666
8	8 48 05.716 ^s	148.044	8	10 43 07.107 ^s	139.499
9	8 50 33.618 ^s	147.902	9	10 45 26.440 ^s	139.333
10	8 53 01.374 ^s	147.756	10	10 47 45.611 ^s	139.171
11	8 55 28.980 ^s	147.606	11	10 50 04.622 ^s	139.011
12	8 57 56.434 ^s	147.454	12	10 52 23.475 ^s	138.853
13	9 00 23.733 ^s	147.299	13	10 54 42.173 ^s	138.698
14	9 02 50.872 ^s	147.139	14	10 57 00.719 ^s	138.546
15	9 05 17.850 ^s	146.978	15	10 59 19.115 ^s	138.396
16	9 07 44.663 ^s	146.813	16	11 01 37.365 ^s	138.250
17	9 10 11.309 ^s	146.646	17	11 03 55.471 ^s	138.106
18	9 12 37.785 ^s	146.476	18	11 06 13.437 ^s	137.966
19	9 15 04.089 ^s	146.304	19	11 08 31.266 ^s	137.829
20	9 17 30.218 ^s	146.129	20	11 10 48.960 ^s	137.694
21	9 19 56.171 ^s	145.953	21	11 13 06.523 ^s	137.563
22	9 22 21.946 ^s	145.775	22	11 15 23.959 ^s	137.436
23	9 24 47.541 ^s	145.595	23	11 17 41.271 ^s	137.312
		145.412			137.191
		+20 35 16.23			-708.04
March 23			March 25		
0	9 27 12.953 ^{h m s}	+20 23 28.19 ^{° ' "}	0	11 19 58.462 ^{h m s}	+8 38 05.20 ^{° ' "}
1	9 29 38.182 ^s	145.229	1	11 22 15.536 ^s	137.074
2	9 32 03.227 ^s	145.045	2	11 24 32.496 ^s	136.960
3	9 34 28.085 ^s	144.858	3	11 26 49.346 ^s	136.850
4	9 36 52.756 ^s	144.671	4	11 29 06.091 ^s	136.745
5	9 39 17.239 ^s	144.483	5	11 31 22.732 ^s	136.641
6	9 41 41.532 ^s	144.293	6	11 33 39.275 ^s	136.543
7	9 44 05.636 ^s	144.104	7	11 35 55.723 ^s	136.448
8	9 46 29.550 ^s	143.914	8	11 38 12.081 ^s	136.358
9	9 48 53.273 ^s	143.723	9	11 40 28.351 ^s	136.270
10	9 51 16.805 ^s	143.532	10	11 42 44.538 ^s	136.187
11	9 53 40.145 ^s	143.340	11	11 45 00.646 ^s	136.108
12	9 56 03.294 ^s	143.149	12	11 47 16.680 ^s	136.034
13	9 58 26.252 ^s	142.958	13	11 49 32.642 ^s	135.962
14	10 00 49.019 ^s	142.767	14	11 51 48.538 ^s	135.896
15	10 03 11.595 ^s	142.576	15	11 54 04.371 ^s	135.833
16	10 05 33.981 ^s	142.386	16	11 56 20.146 ^s	135.775
17	10 07 56.177 ^s	142.196	17	11 58 35.867 ^s	135.721
18	10 10 18.184 ^s	142.007	18	12 00 51.538 ^s	135.671
19	10 12 40.003 ^s	141.819	19	12 03 07.164 ^s	135.626
20	10 15 01.635 ^s	141.632	20	12 05 22.748 ^s	135.584
21	10 17 23.080 ^s	141.445	21	12 07 38.296 ^s	135.548
22	10 19 44.341 ^s	141.261	22	12 09 53.810 ^s	135.514
23	10 22 05.418 ^s	141.077	23	12 12 09.297 ^s	135.487
24	10 24 26.312 ^s	140.894	24	12 14 24.760 ^s	135.463
		+15 01 02.84			+1 39 46.54

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 26			March 28		
h	h m s	° ' " s	h	h m s	° ' " s
0	12 14 24.760	135.443	0	14 03 43.731	139.467
1	12 16 40.203	135.428	1	14 06 03.198	139.639
2	12 18 55.631	135.418	2	14 08 22.837	139.814
3	12 21 11.049	135.412	3	14 10 42.651	139.992
4	12 23 26.461	135.409	4	14 13 02.643	140.171
5	12 25 41.870	135.413	5	14 15 22.814	140.354
6	12 27 57.283	135.419	6	14 17 43.168	140.538
7	12 30 12.702	135.431	7	14 20 03.706	140.725
8	12 32 28.133	135.447	8	14 22 24.431	140.913
9	12 34 43.580	135.467	9	14 24 45.344	141.103
10	12 36 59.047	135.492	10	14 27 06.447	141.296
11	12 39 14.539	135.522	11	14 29 27.743	141.490
12	12 41 30.061	135.555	12	14 31 49.233	141.684
13	12 43 45.616	135.593	13	14 34 10.917	141.882
14	12 46 01.209	135.636	14	14 36 32.799	142.080
15	12 48 16.845	135.682	15	14 38 54.879	142.280
16	12 50 32.527	135.734	16	14 41 17.159	142.481
17	12 52 48.261	135.789	17	14 43 39.640	142.682
18	12 55 04.050	135.849	18	14 46 02.322	142.884
19	12 57 19.899	135.913	19	14 48 25.206	143.088
20	12 59 35.812	135.981	20	14 50 48.294	143.292
21	13 01 51.793	136.054	21	14 53 11.586	143.497
22	13 04 07.847	136.131	22	14 55 35.083	143.701
23	13 06 23.978	136.212	23	14 57 58.784	143.907
March 27			March 29		
0	13 08 40.190	136.297	0	15 00 22.691	144.111
1	13 10 56.487	136.386	1	15 02 46.802	144.317
2	13 13 12.873	136.480	2	15 05 11.119	144.523
3	13 15 29.353	136.577	3	15 07 35.642	144.727
4	13 17 45.930	136.679	4	15 10 00.369	144.931
5	13 20 02.609	136.784	5	15 12 25.300	145.136
6	13 22 19.393	136.893	6	15 14 50.436	145.338
7	13 24 36.286	137.007	7	15 17 15.774	145.541
8	13 26 53.293	137.123	8	15 19 41.315	145.743
9	13 29 10.416	137.245	9	15 22 07.058	145.942
10	13 31 27.661	137.368	10	15 24 33.000	146.142
11	13 33 45.029	137.497	11	15 26 59.142	146.340
12	13 36 02.526	137.629	12	15 29 25.482	146.535
13	13 38 20.155	137.764	13	15 31 52.017	146.730
14	13 40 37.919	137.902	14	15 34 18.747	146.923
15	13 42 55.821	138.045	15	15 36 45.670	147.113
16	13 45 13.866	138.190	16	15 39 12.783	147.301
17	13 47 32.056	138.339	17	15 41 40.084	147.488
18	13 49 50.395	138.492	18	15 44 07.572	147.671
19	13 52 08.887	138.646	19	15 46 35.243	147.853
20	13 54 27.533	138.805	20	15 49 03.096	148.031
21	13 56 46.338	138.966	21	15 51 31.127	148.207
22	13 59 05.304	139.130	22	15 53 59.334	148.379
23	14 01 24.434	139.297	23	15 56 27.713	148.549
24	14 03 43.731	139.467	24	15 58 56.262	148.713

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
March 30			April 1		
^h 0	^h 15 ^m 58 ^s 56.262 ^s	-22° 48' 30".18	^h 0	^h 17 ^m 59 ^s 32.058 ^s	-27° 37' 02".92
1	16 01 24.977 148.715	22 58 27.04 -596.86	1	18 02 02.531 150.473	27 38 50.36 -107.44
2	16 03 53.855 148.878	23 08 14.45 587.41	2	18 04 32.880 150.349	27 40 27.52 97.16
3	16 06 22.891 149.036	23 17 52.33 577.88	3	18 07 03.097 150.217	27 41 54.42 86.90
4	16 08 52.083 149.192	23 27 20.63 568.30	4	18 09 33.175 150.078	27 43 11.10 76.68
5	16 11 21.427 149.344	23 36 39.30 558.67	5	18 12 03.108 149.933	27 44 17.57 66.47
6	16 13 50.918 149.491	23 45 48.29 548.99	6	18 14 32.888 149.780	27 45 13.87 56.30
7	16 16 20.553 149.635	23 54 47.55 539.26	7	18 17 02.510 149.622	27 46 00.04 46.17
8	16 18 50.326 149.773	24 03 37.02 529.47	8	18 19 31.965 149.455	27 46 36.09 36.05
9	16 21 20.234 149.908	24 12 16.67 519.65	9	18 22 01.247 149.282	27 47 02.07 25.98
10	16 23 50.273 150.039	24 20 46.43 509.76	10	18 24 30.350 149.103	27 47 18.02 15.95
11	16 26 20.436 150.163	24 29 06.28 499.85	11	18 26 59.267 148.917	27 47 23.95 5.93
12	16 28 50.721 150.285	24 37 16.17 489.89	12	18 29 27.991 148.724	27 47 19.93 + 4.02
13	16 31 21.121 150.400	24 45 16.05 479.88	13	18 31 56.517 148.526	27 47 05.98 13.95
14	16 33 51.631 150.510	24 53 05.89 469.84	14	18 34 24.836 148.319	27 46 42.14 23.84
15	16 36 22.247 150.616	25 00 45.66 459.77	15	18 36 52.945 148.109	27 46 08.46 33.68
16	16 38 52.963 150.716	25 08 15.31 449.65	16	18 39 20.835 147.890	27 45 24.98 43.48
17	16 41 23.774 150.811	25 15 34.81 439.50	17	18 41 48.501 147.666	27 44 31.74 53.24
18	16 43 54.674 150.900	25 22 44.13 429.32	18	18 44 15.938 147.437	27 43 28.80 62.94
19	16 46 25.658 150.984	25 29 43.23 419.10	19	18 46 43.138 147.200	27 42 16.19 72.61
20	16 48 56.719 151.061	25 36 32.10 408.87	20	18 49 10.097 146.959	27 40 53.96 82.23
21	16 51 27.852 151.133	25 43 10.71 398.61	21	18 51 36.808 146.711	27 39 22.17 91.79
22	16 53 59.051 151.199	25 49 39.02 388.31	22	18 54 03.265 146.457	27 37 40.86 101.31
23	16 56 30.310 151.259	25 55 57.02 378.00	23	18 56 29.465 146.200	27 35 50.08 110.78
	151.313	-367.66		145.935	+120.19
March 31			April 2		
0	16 59 01.623 151.361	-26° 02' 04".68	0	18 58 55.400 145.665	-27° 33' 49".89
1	17 01 32.984 151.401	26 08 01.98 -357.30	1	19 01 21.065 145.665	27 31 40.34 +129.55
2	17 04 04.385 151.437	26 13 48.91 346.93	2	19 03 46.456 145.391	27 29 21.49 138.85
3	17 06 35.822 151.465	26 19 25.45 336.54	3	19 06 11.567 145.111	27 26 53.38 148.11
4	17 09 07.287 151.486	26 24 51.59 326.14	4	19 08 36.393 144.826	27 24 16.07 157.31
5	17 11 38.773 151.502	26 30 07.31 315.72	5	19 11 00.930 144.537	27 21 29.63 166.44
6	17 14 10.275 151.510	26 35 12.60 305.29	6	19 13 25.173 144.243	27 18 34.10 175.53
7	17 16 41.785 151.512	26 40 07.46 294.86	7	19 15 49.117 143.944	27 15 29.56 184.54
8	17 19 13.297 151.512	26 44 51.87 284.41	8	19 18 12.758 143.641	27 12 16.04 193.52
9	17 21 44.804 151.507	26 49 25.83 273.96	9	19 20 36.091 143.333	27 08 53.63 202.41
10	17 24 16.299 151.495	26 53 49.34 263.51	10	19 22 59.112 143.021	27 05 22.37 211.26
11	17 26 47.775 151.476	26 58 02.39 253.05	11	19 25 21.818 142.706	27 01 42.33 220.04
12	17 29 19.226 151.451	27 02 04.99 242.60	12	19 27 44.203 142.385	26 57 53.57 228.76
13	17 31 50.643 151.417	27 05 57.14 232.15	13	19 30 06.265 142.062	26 53 56.15 237.42
14	17 34 22.021 151.378	27 09 38.83 221.69	14	19 32 28.000 141.735	26 49 50.14 246.01
15	17 36 53.352 151.331	27 13 10.08 211.25	15	19 34 49.403 141.403	26 45 35.61 254.53
16	17 39 24.630 151.278	27 16 30.89 200.81	16	19 37 10.473 141.070	26 41 12.60 263.01
17	17 41 55.846 151.216	27 19 41.26 190.37	17	19 39 31.205 140.732	26 36 41.20 271.40
18	17 44 26.994 151.148	27 22 41.22 179.96	18	19 41 51.596 140.391	26 32 01.46 279.74
19	17 46 58.067 151.073	27 25 30.77 169.55	19	19 44 11.643 140.047	26 27 13.45 288.01
20	17 49 29.058 150.991	27 28 09.92 159.15	20	19 46 31.344 139.701	26 22 17.24 296.21
21	17 51 59.960 150.902	27 30 38.70 148.78	21	19 48 50.695 139.351	26 17 12.90 304.34
22	17 54 30.765 150.805	27 32 57.11 138.41	22	19 51 09.695 139.000	26 12 00.49 312.41
23	17 57 01.467 150.702	27 35 05.18 128.07	23	19 53 28.340 138.645	26 06 40.08 320.41
24	17 59 32.058 150.591	-27° 37' 02".92 -117.74	24	19 55 46.629 138.289	-26° 01' 11".73 +328.35

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 3			April 5		
0	19 55 46.629 ^s	-26 01 11.73	0	21 39 09.917 ^s	-19 25 41.34
1	19 58 04.558 ^s	25 55 35.52	1	21 41 10.347 ^s	19 15 08.84
2	20 00 22.126 ^s	25 49 51.52	2	21 43 10.448 ^s	19 04 31.81
3	20 02 39.332 ^s	25 43 59.79	3	21 45 10.221 ^s	18 53 50.30
4	20 04 56.172 ^s	25 38 00.40	4	21 47 09.670 ^s	18 43 04.37
5	20 07 12.646 ^s	25 31 53.43	5	21 49 08.796 ^s	18 32 14.09
6	20 09 28.753 ^s	25 25 38.93	6	21 51 07.604 ^s	18 21 19.51
7	20 11 44.489 ^s	25 19 16.98	7	21 53 06.095 ^s	18 10 20.70
8	20 13 59.855 ^s	25 12 47.66	8	21 55 04.272 ^s	17 59 17.71
9	20 16 14.850 ^s	25 06 11.03	9	21 57 02.139 ^s	17 48 10.61
10	20 18 29.471 ^s	24 59 27.15	10	21 58 59.699 ^s	17 36 59.46
11	20 20 43.718 ^s	24 52 36.11	11	22 00 56.954 ^s	17 25 44.31
12	20 22 57.591 ^s	24 45 37.96	12	22 02 53.908 ^s	17 14 25.23
13	20 25 11.088 ^s	24 38 32.79	13	22 04 50.563 ^s	17 03 02.27
14	20 27 24.210 ^s	24 31 20.65	14	22 06 46.924 ^s	16 51 35.49
15	20 29 36.956 ^s	24 24 01.63	15	22 08 42.992 ^s	16 40 04.95
16	20 31 49.324 ^s	24 16 35.79	16	22 10 38.772 ^s	16 28 30.71
17	20 34 01.316 ^s	24 09 03.19	17	22 12 34.266 ^s	16 16 52.82
18	20 36 12.932 ^s	24 01 23.92	18	22 14 29.478 ^s	16 05 11.34
19	20 38 24.170 ^s	23 53 38.04	19	22 16 24.411 ^s	15 53 26.33
20	20 40 35.032 ^s	23 45 45.62	20	22 18 19.069 ^s	15 41 37.85
21	20 42 45.517 ^s	23 37 46.73	21	22 20 13.454 ^s	15 29 45.94
22	20 44 55.626 ^s	23 29 41.44	22	22 22 07.571 ^s	15 17 50.67
23	20 47 05.360 ^s	-23 21 29.82	23	22 24 01.422 ^s	-15 05 52.09
		+497.88			+721.84
April 4			April 6		
0	20 49 14.718 ^s	-23 13 11.94	0	22 25 55.012 ^s	-14 53 50.25
1	20 51 23.703 ^s	23 04 47.87	1	22 27 48.343 ^s	14 41 45.22
2	20 53 32.313 ^s	22 56 17.68	2	22 29 41.419 ^s	14 29 37.03
3	20 55 40.551 ^s	22 47 41.43	3	22 31 34.244 ^s	14 17 25.76
4	20 57 48.417 ^s	22 38 59.19	4	22 33 26.821 ^s	14 05 11.45
5	20 59 55.912 ^s	22 30 11.04	5	22 35 19.154 ^s	13 52 54.15
6	21 02 03.038 ^s	22 21 17.05	6	22 37 11.246 ^s	13 40 33.93
7	21 04 09.796 ^s	22 12 17.27	7	22 39 03.102 ^s	13 28 10.82
8	21 06 16.186 ^s	22 03 11.78	8	22 40 54.724 ^s	13 15 44.89
9	21 08 22.211 ^s	21 54 00.64	9	22 42 46.116 ^s	13 03 16.18
10	21 10 27.872 ^s	21 44 43.93	10	22 44 37.282 ^s	12 50 44.75
11	21 12 33.170 ^s	21 35 21.71	11	22 46 28.225 ^s	12 38 10.65
12	21 14 38.107 ^s	21 25 54.04	12	22 48 18.950 ^s	12 25 33.93
13	21 16 42.686 ^s	21 16 20.99	13	22 50 09.460 ^s	12 12 54.65
14	21 18 46.907 ^s	21 06 42.64	14	22 51 59.759 ^s	12 00 12.84
15	21 20 50.772 ^s	20 56 59.04	15	22 53 49.850 ^s	11 47 28.57
16	21 22 54.284 ^s	20 47 10.26	16	22 55 39.737 ^s	11 34 41.88
17	21 24 57				

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 7			April 9		
h	h m s	° ' "	h	h m s	° ' "
0	23 10 11.949	108.223	0	0 34 46.432	104.626
1	23 12 00.172	108.056	1	0 36 31.058	104.646
2	23 13 48.228	107.895	2	0 38 15.704	104.670
3	23 15 36.123	107.737	3	0 40 00.374	104.697
4	23 17 23.860	107.582	4	0 41 45.071	104.729
5	23 19 11.442	107.432	5	0 43 29.800	104.764
6	23 20 58.874	107.285	6	0 45 14.564	104.802
7	23 22 46.159	107.143	7	0 46 59.366	104.845
8	23 24 33.302	107.003	8	0 48 44.211	104.892
9	23 26 20.305	106.869	9	0 50 29.103	104.942
10	23 28 07.174	106.737	10	0 52 14.045	104.996
11	23 29 53.911	106.610	11	0 53 59.041	105.055
12	23 31 40.521	106.486	12	0 55 44.096	105.115
13	23 33 27.007	106.367	13	0 57 29.211	105.181
14	23 35 13.374	106.251	14	0 59 14.392	105.251
15	23 36 59.625	106.140	15	1 00 59.643	105.323
16	23 38 45.765	106.031	16	1 02 44.966	105.401
17	23 40 31.796	105.928	17	1 04 30.367	105.481
18	23 42 17.724	105.827	18	1 06 15.848	105.565
19	23 44 03.551	105.731	19	1 08 01.413	105.653
20	23 45 49.282	105.639	20	1 09 47.066	105.745
21	23 47 34.921	105.550	21	1 11 32.811	105.841
22	23 49 20.471	105.465	22	1 13 18.652	105.939
23	23 51 05.936	105.385	23	1 15 04.591	106.043
April 8			April 10		
0	23 52 51.321	105.308	0	1 16 50.634	106.150
1	23 54 36.629	105.236	1	1 18 36.784	106.259
2	23 56 21.865	105.166	2	1 20 23.043	106.374
3	23 58 07.031	105.101	3	1 22 09.417	106.492
4	23 59 52.132	105.039	4	1 23 55.909	106.613
5	0 01 37.171	104.983	5	1 25 42.522	106.739
6	0 03 22.154	104.928	6	1 27 29.261	106.867
7	0 05 07.082	104.879	7	1 29 16.128	106.999
8	0 06 51.961	104.834	8	1 31 03.127	107.136
9	0 08 36.795	104.791	9	1 32 50.263	107.275
10	0 10 21.586	104.754	10	1 34 37.538	107.419
11	0 12 06.340	104.719	11	1 36 24.957	107.566
12	0 13 51.059	104.689	12	1 38 12.523	107.716
13	0 15 35.748	104.662	13	1 40 00.239	107.870
14	0 17 20.410	104.640	14	1 41 48.109	108.029
15	0 19 05.050	104.622	15	1 43 36.138	108.189
16	0 20 49.672	104.606	16	1 45 24.327	108.354
17	0 22 34.278	104.595	17	1 47 12.681	108.523
18	0 24 18.873	104.589	18	1 49 01.204	108.694
19	0 26 03.462	104.585	19	1 50 49.898	108.870
20	0 27 48.047	104.586	20	1 52 38.768	109.049
21	0 29 32.633	104.590	21	1 54 27.817	109.231
22	0 31 17.223	104.598	22	1 56 17.048	109.417
23	0 33 01.821	104.611	23	1 58 06.465	109.607
24	0 34 46.432	104.611	24	1 59 56.072	109.800

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension		Apparent Declination		Hour	Apparent Right Ascension		Apparent Declination	
April 11					April 13				
0	1 59 56.072	109.798	+11 45 01.16	+764.10	0	3 32 21.013	122.528	+20 53 43.90	+582.00
1	2 01 45.870	109.995	11 57 45.26	761.60	1	3 34 23.541	122.849	21 03 25.90	576.76
2	2 03 35.865	110.195	12 10 26.86	759.06	2	3 36 26.390	123.171	21 13 02.66	571.46
3	2 05 26.060	110.397	12 23 05.92	756.45	3	3 38 29.561	123.494	21 22 34.12	566.00
4	2 07 16.457	110.604	12 35 42.37	753.80	4	3 40 33.055	123.819	21 32 00.21	560.68
5	2 09 07.061	110.813	12 48 16.17	751.10	5	3 42 36.874	124.145	21 41 20.89	555.18
6	2 10 57.874	111.026	13 00 47.27	748.35	6	3 44 41.019	124.472	21 50 36.07	549.64
7	2 12 48.900	111.243	13 13 15.62	745.53	7	3 46 45.491	124.799	21 59 45.71	544.02
8	2 14 40.143	111.461	13 25 41.15	742.67	8	3 48 50.290	125.127	22 08 49.73	538.35
9	2 16 31.604	111.684	13 38 03.82	739.75	9	3 50 55.417	125.457	22 17 48.08	532.62
10	2 18 23.288	111.910	13 50 23.57	736.79	10	3 53 00.874	125.787	22 26 40.70	526.81
11	2 20 15.198	112.140	14 02 40.36	733.77	11	3 55 06.661	126.118	22 35 27.51	520.94
12	2 22 07.338	112.371	14 14 54.13	730.68	12	3 57 12.779	126.448	22 44 08.45	515.02
13	2 23 59.709	112.606	14 27 04.81	727.56	13	3 59 19.227	126.781	22 52 43.47	509.03
14	2 25 52.315	112.845	14 39 12.37	724.37	14	4 01 26.008	127.111	23 01 12.50	502.98
15	2 27 45.160	113.087	14 51 16.74	721.14	15	4 03 33.119	127.445	23 09 35.48	496.86
16	2 29 38.247	113.331	15 03 17.88	717.83	16	4 05 40.564	127.776	23 17 52.34	490.67
17	2 31 31.578	113.578	15 15 15.71	714.49	17	4 07 48.340	128.108	23 26 03.01	484.44
18	2 33 25.156	113.829	15 27 10.20	711.09	18	4 09 56.448	128.441	23 34 07.45	478.13
19	2 35 18.985	114.083	15 39 01.29	707.62	19	4 12 04.889	128.773	23 42 05.58	471.76
20	2 37 13.068	114.339	15 50 48.91	704.11	20	4 14 13.662	129.105	23 49 57.34	465.33
21	2 39 07.407	114.598	16 02 33.02	700.53	21	4 16 22.767	129.437	23 57 42.67	458.84
22	2 41 02.005	114.861	16 14 13.55	696.91	22	4 18 32.204	129.767	24 05 21.51	452.27
23	2 42 56.866	115.126	+16 25 50.46	+693.22	23	4 20 41.971	130.099	+24 12 53.78	+445.66
April 12					April 14				
0	2 44 51.992	115.393	+16 37 23.68	+689.48	0	4 22 52.070	130.428	+24 20 19.44	+438.98
1	2 46 47.385	115.663	16 48 53.16	685.67	1	4 25 02.498	130.757	24 27 38.42	432.22
2	2 48 43.048	115.937	17 00 18.83	681.83	2	4 27 13.255	131.086	24 34 50.64	425.42
3	2 50 38.985	116.212	17 11 40.66	677.90	3	4 29 24.341	131.413	24 41 56.06	418.56
4	2 52 35.197	116.491	17 22 58.56	673.94	4	4 31 35.754	131.740	24 48 54.62	411.61
5	2 54 31.688	116.772	17 34 12.50	669.90	5	4 33 47.494	132.065	24 55 46.23	404.63
6	2 56 28.460	117.055	17 45 22.40	665.82	6	4 35 59.559	132.388	25 02 30.86	397.57
7	2 58 25.515	117.342	17 56 28.22	661.67	7	4 38 11.947	132.712	25 09 08.43	390.45
8	3 00 22.857	117.629	18 07 29.89	657.46	8	4 40 24.659	133.032	25 15 38.88	383.27
9	3 02 20.486	117.920	18 18 27.35	653.19	9	4 42 37.691	133.352	25 22 02.15	376.04
10	3 04 18.406	118.214	18 29 20.54	648.88	10	4 44 51.043	133.669	25 28 18.19	368.74
11	3 06 16.620	118.508	18 40 09.42	644.49	11	4 47 04.712	133.986	25 34 26.93	361.37
12	3 08 15.128	118.806	18 50 53.91	640.04	12	4 49 18.698	134.299	25 40 28.30	353.96
13	3 10 13.934	119.106	19 01 33.95	635.54	13	4 51 32.997	134.612	25 46 22.26	346.48
14	3 12 13.040	119.407	19 12 09.49	630.98	14	4 53 47.609	134.921	25 52 08.74	338.94
15	3 14 12.447	119.712	19 22 40.47	626.36	15	4 56 02.530	135.229	25 57 47.68	331.34
16	3 16 12.159	120.017	19 33 06.83	621.67	16	4 58 17.759	135.534	26 03 19.02	323.69
17	3 18 12.176	120.325	19 43 28.50	616.92	17	5 00 33.293	135.837	26 08 42.71	315.97
18	3 20 12.501	120.634	19 53 45.42	612.12	18	5 02 49.130	136.136	26 13 58.68	308.21
19	3 22 13.135	120.946	20 03 57.54	607.25	19	5 05 05.266	136.434	26 19 06.89	300.37
20	3 24 14.081	121.259	20 14 04.79	602.33	20	5 07 21.700	136.729	26 24 07.26	292.49
21	3 26 15.340	121.574	20 24 07.12	597.33	21	5 09 38.429	137.020	26 28 59.75	284.55
22	3 28 16.914	121.891	20 34 04.45	592.28	22	5 11 55.449	137.309	26 33 44.30	276.55
23	3 30 18.805	122.208	20 43 56.73	+587.17	23	5 14 12.758	137.595	26 38 20.85	+268.50
24	3 32 21.013		+20 53 43.90		24	5 16 30.353		+26 42 49.35	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 15			April 17		
h	h m s	° ' "	h	h m s	° ' "
0	5 16 30.353 ^s	+26 42 49.35 ["]	0	7 10 44.899 ^s	+27 25 00.30 ["]
1	5 18 48.229 ^s	137.876 ["]	1	7 13 10.753 ^s	145.854 ["]
2	5 21 06.384 ^s	138.155 ["]	2	7 15 36.634 ^s	145.881 ["]
3	5 23 24.815 ^s	138.431 ["]	3	7 18 02.537 ^s	145.903 ["]
4	5 25 43.517 ^s	138.702 ["]	4	7 20 28.457 ^s	145.920 ["]
5	5 28 02.487 ^s	138.970 ["]	5	7 22 54.386 ^s	145.929 ["]
6	5 30 21.721 ^s	139.234 ["]	6	7 25 20.320 ^s	145.934 ["]
7	5 32 41.216 ^s	139.495 ["]	7	7 27 46.252 ^s	145.932 ["]
8	5 35 00.967 ^s	139.751 ["]	8	7 30 12.178 ^s	145.926 ["]
9	5 37 20.971 ^s	140.004 ["]	9	7 32 38.091 ^s	145.913 ["]
10	5 39 41.222 ^s	140.251 ["]	10	7 35 03.986 ^s	145.895 ["]
11	5 42 01.717 ^s	140.495 ["]	11	7 37 29.857 ^s	145.871 ["]
12	5 44 22.451 ^s	140.734 ["]	12	7 39 55.699 ^s	145.842 ["]
13	5 46 43.420 ^s	140.969 ["]	13	7 42 21.506 ^s	145.807 ["]
14	5 49 04.619 ^s	141.199 ["]	14	7 44 47.274 ^s	145.768 ["]
15	5 51 26.044 ^s	141.425 ["]	15	7 47 12.997 ^s	145.723 ["]
16	5 53 47.690 ^s	141.646 ["]	16	7 49 38.669 ^s	145.672 ["]
17	5 56 09.552 ^s	141.862 ["]	17	7 52 04.286 ^s	145.617 ["]
18	5 58 31.625 ^s	142.073 ["]	18	7 54 29.843 ^s	145.557 ["]
19	6 00 53.903 ^s	142.278 ["]	19	7 56 55.335 ^s	145.492 ["]
20	6 03 16.383 ^s	142.480 ["]	20	7 59 20.757 ^s	145.422 ["]
21	6 05 39.059 ^s	142.676 ["]	21	8 01 46.104 ^s	145.347 ["]
22	6 08 01.925 ^s	142.866 ["]	22	8 04 11.372 ^s	145.268 ["]
23	6 10 24.976 ^s	143.051 ["]	23	8 06 36.556 ^s	145.184 ["]
	143.232 ["]	+27 46 46.03 ["]		145.096 ["]	+25 36 37.70 ["]
April 16			April 18		
h	h m s	° ' "	h	h m s	° ' "
0	6 12 48.208	+27 47 46.58 ["]	0	8 09 01.652	+25 30 00.20 ["]
1	6 15 11.613	143.405 ["]	1	8 11 26.654	145.002 ["]
2	6 17 35.188	143.575 ["]	2	8 13 51.560	144.906 ["]
3	6 19 58.926	143.738 ["]	3	8 16 16.365	144.805 ["]
4	6 22 22.822	143.896 ["]	4	8 18 41.065	144.700 ["]
5	6 24 46.870	144.048 ["]	5	8 21 05.655	144.590 ["]
6	6 27 11.064	144.194 ["]	6	8 23 30.133	144.478 ["]
7	6 29 35.399	144.335 ["]	7	8 25 54.494	144.361 ["]
8	6 31 59.869	144.470 ["]	8	8 28 18.734	144.240 ["]
9	6 34 24.468	144.599 ["]	9	8 30 42.851	144.117 ["]
10	6 36 49.191	144.723 ["]	10	8 33 06.841	143.990 ["]
11	6 39 14.030	144.839 ["]	11	8 35 30.701	143.860 ["]
12	6 41 38.981	144.951 ["]	12	8 37 54.427	143.726 ["]
13	6 44 04.037	145.056 ["]	13	8 40 18.016	143.589 ["]
14	6 46 29.193	145.156 ["]	14	8 42 41.467	143.451 ["]
15	6 48 54.442	145.249 ["]	15	8 45 04.774	143.307 ["]
16	6 51 19.778	145.336 ["]	16	8 47 27.938	143.164 ["]
17	6 53 45.196	145.418 ["]	17	8 49 50.953	143.015 ["]
18	6 56 10.690	145.494 ["]	18	8 52 13.819	142.866 ["]
19	6 58 36.253	145.563 ["]	19	8 54 36.533	142.714 ["]
20	7 01 01.879	145.626 ["]	20	8 56 59.093	142.560 ["]
21	7 03 27.563	145.684 ["]	21	8 59 21.496	142.403 ["]
22	7 05 53.298	145.735 ["]	22	9 01 43.742	142.246 ["]
23	7 08 19.079	145.781 ["]	23	9 04 05.827	142.085 ["]
24	7 10 44.899	145.820 ["]	24	9 06 27.751	141.924 ["]
		+27 25 00.30 ["]			+22 05 14.77 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 19			April 21		
h	h m s	° ' "	h	h m s	° ' "
0	9 06 27.751 141.761	+22 05 14.77 -621.90	0	10 56 47.481 134.414	+11 28 53.04 -947.00
1	9 08 49.512 141.596	21 54 52.87 630.28	1	10 59 01.895 134.312	11 13 06.04 951.78
2	9 11 11.108 141.430	21 44 22.59 638.61	2	11 01 16.207 134.214	10 57 14.26 956.46
3	9 13 32.538 141.264	21 33 43.98 646.88	3	11 03 30.421 134.119	10 41 17.80 961.05
4	9 15 53.802 141.095	21 22 57.10 655.10	4	11 05 44.540 134.029	10 25 16.75 965.55
5	9 18 14.897 140.926	21 12 02.00 663.26	5	11 07 58.569 133.942	10 09 11.20 969.94
6	9 20 35.823 140.757	21 00 58.74 671.36	6	11 10 12.511 133.859	9 53 01.26 974.25
7	9 22 56.580 140.587	20 49 47.38 679.40	7	11 12 26.370 133.778	9 36 47.01 978.44
8	9 25 17.167 140.415	20 38 27.98 687.38	8	11 14 40.148 133.704	9 20 28.57 982.56
9	9 27 37.582 140.244	20 27 00.60 695.30	9	11 16 53.852 133.631	9 04 06.01 986.56
10	9 29 57.826 140.073	20 15 25.30 703.15	10	11 19 07.483 133.564	8 47 39.45 990.47
11	9 32 17.899 139.901	20 03 42.15 710.94	11	11 21 21.047 133.500	8 31 08.98 994.28
12	9 34 37.800 139.729	19 51 51.21 718.67	12	11 23 34.547 133.439	8 14 34.70 997.98
13	9 36 57.529 139.557	19 39 52.54 726.33	13	11 25 47.986 133.384	7 57 56.72 1001.59
14	9 39 17.086 139.385	19 27 46.21 733.93	14	11 28 01.370 133.333	7 41 15.13 1005.10
15	9 41 36.471 139.215	19 15 32.28 741.46	15	11 30 14.703 133.285	7 24 30.03 1008.49
16	9 43 55.686 139.043	19 03 10.82 748.92	16	11 32 27.988 133.243	7 07 41.54 1011.80
17	9 46 14.729 138.873	18 50 41.90 756.31	17	11 34 41.231 133.203	6 50 49.74 1014.99
18	9 48 33.602 138.703	18 38 05.59 763.63	18	11 36 54.434 133.169	6 33 54.75 1018.08
19	9 50 52.305 138.534	18 25 21.96 770.89	19	11 39 07.603 133.138	6 16 56.67 1021.06
20	9 53 10.839 138.366	18 12 31.07 778.06	20	11 41 20.741 133.113	5 59 55.61 1023.94
21	9 55 29.205 138.199	17 59 33.01 785.18	21	11 43 33.854 133.091	5 42 51.67 1026.72
22	9 57 47.404 138.033	17 46 27.83 792.21	22	11 45 46.945 133.074	5 25 44.95 1029.37
23	10 00 05.437 137.868	+17 33 15.62 -799.17	23	11 48 00.019 133.062	+ 5 08 35.58 -1031.94
April 20			April 22		
0	10 02 23.305 137.704	+17 19 56.45 -806.06	0	11 50 13.081 133.053	+ 4 51 23.64 -1034.39
1	10 04 41.009 137.542	17 06 30.39 812.87	1	11 52 26.134 133.051	4 34 09.25 1036.72
2	10 06 58.551 137.382	16 52 57.52 819.61	2	11 54 39.185 133.051	4 16 52.53 1038.96
3	10 09 15.933 137.222	16 39 17.91 826.27	3	11 56 52.236 133.057	3 59 33.57 1041.07
4	10 11 33.155 137.065	16 25 31.64 832.85	4	11 59 05.293 133.067	3 42 12.50 1043.09
5	10 13 50.220 136.909	16 11 38.79 839.35	5	12 01 18.360 133.082	3 24 49.41 1044.98
6	10 16 07.129 136.755	15 57 39.44 845.78	6	12 03 31.442 133.101	3 07 24.43 1046.77
7	10 18 23.884 136.604	15 43 33.66 852.12	7	12 05 44.543 133.126	2 49 57.66 1048.44
8	10 20 40.488 136.454	15 29 21.54 858.39	8	12 07 57.669 133.155	2 32 29.22 1050.00
9	10 22 56.942 136.307	15 15 03.15 864.56	9	12 10 10.824 133.188	2 14 59.22 1051.45
10	10 25 13.249 136.161	15 00 38.59 870.67	10	12 12 24.012 133.226	1 57 27.77 1052.78
11	10 27 29.410 136.019	14 46 07.92 876.68	11	12 14 37.238 133.269	1 39 54.99 1054.00
12	10 29 45.429 135.878	14 31 31.24 882.61	12	12 16 50.507 133.317	1 22 20.99 1055.10
13	10 32 01.307 135.740	14 16 48.63 888.46	13	12 19 03.824 133.369	1 04 45.89 1056.09
14	10 34 17.047 135.605	14 02 00.17 894.23	14	12 21 17.193 133.427	0 47 09.80 1056.95
15	10 36 32.652 135.473	13 47 05.94 899.90	15	12 23 30.620 133.488	0 29 32.85 1057.71
16	10 38 48.125 135.343	13 32 06.04 905.49	16	12 25 44.108 133.555	+ 0 11 55.14 1058.34
17	10 41 03.468 135.215	13 17 00.55 910.99	17	12 27 57.663 133.626	- 0 05 43.20 1058.87
18	10 43 18.683 135.092	13 01 49.56 916.41	18	12 30 11.289 133.702	0 23 22.07 1059.26
19	10 45 33.775 134.971	12 46 33.15 921.73	19	12 32 24.991 133.783	0 41 01.33 1059.54
20	10 47 48.746 134.852	12 31 11.42 926.97	20	12 34 38.774 133.868	0 58 40.87 1059.70
21	10 50 03.598 134.738	12 15 44.45 932.11	21	12 36 52.642 133.959	1 16 20.57 1059.74
22	10 52 18.336 134.627	12 00 12.34 937.17	22	12 39 06.601 134.053	1 34 00.31 1059.66
23	10 54 32.963 134.518	11 44 35.17 -942.13	23	12 41 20.654 134.154	1 51 39.97 -1059.45
24	10 56 47.481	+11 28 53.04	24	12 43 34.808	- 2 09 19.42

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 23			April 25		
h	h m s	° ' "	h	h m s	° ' "
0	12 43 34.808	-2 09 19.42	0	14 34 15.261	-15 32 17.83
1	12 45 49.065	2 26 58.56	1	14 36 39.243	15 47 14.49
2	12 48 03.432	2 44 37.26	2	14 39 03.498	16 02 04.71
3	12 50 17.912	3 02 15.38	3	14 41 28.024	16 16 48.38
4	12 52 32.510	3 19 52.82	4	14 43 52.825	16 31 25.38
5	12 54 47.232	3 37 29.45	5	14 46 17.899	16 45 55.59
6	12 57 02.081	3 55 05.14	6	14 48 43.249	17 00 18.90
7	12 59 17.062	4 12 39.78	7	14 51 08.874	17 14 35.18
8	13 01 32.179	4 30 13.24	8	14 53 34.775	17 28 44.33
9	13 03 47.438	4 47 45.38	9	14 56 00.951	17 42 46.23
10	13 06 02.842	5 05 16.10	10	14 58 27.403	17 56 40.77
11	13 08 18.397	5 22 45.27	11	15 00 54.132	18 10 27.83
12	13 10 34.106	5 40 12.75	12	15 03 21.135	18 24 07.31
13	13 12 49.973	5 57 38.43	13	15 05 48.414	18 37 39.10
14	13 15 06.004	6 15 02.18	14	15 08 15.966	18 51 03.08
15	13 17 22.203	6 32 23.86	15	15 10 43.793	19 04 19.14
16	13 19 38.573	6 49 43.37	16	15 13 11.891	19 17 27.20
17	13 21 55.119	7 07 00.57	17	15 15 40.261	19 30 27.12
18	13 24 11.845	7 24 15.33	18	15 18 08.902	19 43 18.82
19	13 26 28.756	7 41 27.53	19	15 20 37.810	19 56 02.19
20	13 28 45.855	7 58 37.04	20	15 23 06.986	20 08 37.13
21	13 31 03.145	8 15 43.74	21	15 25 36.427	20 21 03.53
22	13 33 20.632	8 32 47.49	22	15 28 06.130	20 33 21.30
23	13 35 38.320	8 49 48.18	23	15 30 36.095	20 45 30.34
		-1017.49			-720.22
April 24			April 26		
h	h m s	° ' "	h	h m s	° ' "
0	13 37 56.211	-9 06 45.67	0	15 33 06.318	-20 57 30.56
1	13 40 14.309	9 23 39.83	1	15 35 36.796	21 09 21.85
2	13 42 32.619	9 40 30.55	2	15 38 07.528	21 21 04.14
3	13 44 51.143	9 57 17.69	3	15 40 38.510	21 32 37.31
4	13 47 09.886	10 14 01.12	4	15 43 09.739	21 44 01.30
5	13 49 28.851	10 30 40.72	5	15 45 41.212	21 55 15.99
6	13 51 48.041	10 47 16.37	6	15 48 12.925	22 06 21.32
7	13 54 07.459	11 03 47.93	7	15 50 44.875	22 17 17.19
8	13 56 27.109	11 20 15.28	8	15 53 17.057	22 28 03.53
9	13 58 46.994	11 36 38.29	9	15 55 49.469	22 38 40.24
10	14 01 07.117	11 52 56.84	10	15 58 22.104	22 49 07.25
11	14 03 27.480	12 09 10.80	11	16 00 54.960	22 59 24.48
12	14 05 48.088	12 25 20.04	12	16 03 28.031	23 09 31.85
13	14 08 08.941	12 41 24.44	13	16 06 01.313	23 19 29.30
14	14 10 30.043	12 57 23.88	14	16 08 34.801	23 29 16.74
15	14 12 51.397	13 13 18.23	15	16 11 08.490	23 38 54.11
16	14 15 13.005	13 29 07.36	16	16 13 42.374	23 48 21.34
17	14 17 34.869	13 44 51.15	17	16 16 16.448	23 57 38.35
18	14 19 56.991	14 00 29.47	18	16 18 50.706	24 06 45.10
19	14 22 19.374	14 16 02.21	19	16 21 25.143	24 15 41.51
20	14 24 42.020	14 31 29.24	20	16 23 59.752	24 24 27.52
21	14 27 04.929	14 46 50.44	21	16 26 34.528	24 33 03.08
22	14 29 28.105	15 02 05.69	22	16 29 09.463	24 41 28.12
23	14 31 51.548	15 17 14.86	23	16 31 44.553	24 49 42.60
24	14 34 15.261	-15 32 17.83	24	16 34 19.789	24 57 46.46
		-902.97			-483.86

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
April 27			April 29		
^h 0	^h 16 ^m 34 ^s 19.789 ^s	-24° 57' 46".46	^h 0	^h 18 ^m 38 ^s 48.287 ^s	-27° 49' 13".90
1	16 36 55.166 155.377	25 05 39.66 -473.20	1	18 41 20.754 152.467	27 48 21.03 + 52.87
2	16 39 30.676 155.510	25 13 22.14 462.48	2	18 43 52.956 152.202	27 47 17.81 63.22
3	16 42 06.313 155.637	25 20 53.86 451.72	3	18 46 24.886 151.930	27 46 04.28 73.53
4	16 44 42.069 155.756	25 28 14.77 440.91	4	18 48 56.534 151.648	27 44 40.50 83.78
5	16 47 17.936 155.867	25 35 24.84 430.07	5	18 51 27.896 151.362	27 43 06.53 93.97
6	16 49 53.908 155.972	25 42 24.03 419.19	6	18 53 58.964 151.068	27 41 22.44 104.09
7	16 52 29.977 156.069	25 49 12.30 408.27	7	18 56 29.731 150.767	27 39 28.28 114.16
8	16 55 06.135 156.158	25 55 49.61 397.31	8	18 59 00.191 150.460	27 37 24.11 124.17
9	16 57 42.374 156.239	26 02 15.94 386.33	9	19 01 30.337 150.146	27 35 10.01 134.10
10	17 00 18.686 156.312	26 08 31.25 375.31	10	19 04 00.164 149.827	27 32 46.03 143.98
11	17 02 55.064 156.378	26 14 35.52 364.27	11	19 06 29.664 149.500	27 30 12.25 153.78
12	17 05 31.499 156.435	26 20 28.72 353.20	12	19 08 58.832 149.168	27 27 28.73 163.52
13	17 08 07.983 156.484	26 26 10.83 342.11	13	19 11 27.663 148.831	27 24 35.53 173.20
14	17 10 44.507 156.524	26 31 41.83 331.00	14	19 13 56.150 148.487	27 21 32.74 182.79
15	17 13 21.064 156.557	26 37 01.71 319.88	15	19 16 24.289 148.139	27 18 20.42 192.32
16	17 15 57.645 156.581	26 42 10.44 308.73	16	19 18 52.074 147.785	27 14 58.63 201.79
17	17 18 34.241 156.596	26 47 08.01 297.57	17	19 21 19.499 147.425	27 11 27.47 211.16
18	17 21 10.843 156.602	26 51 54.42 286.41	18	19 23 46.561 147.062	27 07 46.99 220.48
19	17 23 47.443 156.600	26 56 29.65 275.23	19	19 26 13.254 146.693	27 03 57.28 229.71
20	17 26 24.032 156.589	27 00 53.71 264.06	20	19 28 39.573 146.319	27 00 57.28 238.88
21	17 29 00.602 156.570	27 05 06.57 252.86	21	19 31 05.515 145.942	26 57 58.40 247.96
22	17 31 37.143 156.541	27 09 08.26 241.69	22	19 33 31.074 145.559	26 55 50.44 256.98
23	17 34 13.647 156.504	27 12 58.75 230.49	23	19 35 56.248 145.174	26 51 33.46 265.90
	156.457	-27 12 58.75 -219.32		144.784	-26 47 07.56 +274.76
April 28			April 30		
0	17 36 50.104 156.403	-27 16 38.07 -208.13	0	19 38 21.032 144.389	-26 42 32.80 +283.54
1	17 39 26.507 156.338	27 20 06.20 196.97	1	19 40 45.421 143.993	26 37 49.26 292.23
2	17 42 02.845 156.265	27 23 23.17 185.81	2	19 43 09.414 143.592	26 32 57.03 300.85
3	17 44 39.110 156.184	27 26 28.98 174.66	3	19 45 33.006 143.188	26 27 56.18 309.40
4	17 47 15.294 156.093	27 29 23.64 163.53	4	19 47 56.194 142.782	26 22 46.78 317.84
5	17 49 51.387 155.993	27 32 07.17 152.42	5	19 50 18.976 142.372	26 17 28.94 326.23
6	17 52 27.380 155.884	27 34 39.59 141.32	6	19 52 41.348 141.959	26 12 02.71 334.52
7	17 55 03.264 155.767	27 37 00.91 130.24	7	19 55 03.307 141.545	26 06 28.19 342.74
8	17 57 39.031 155.641	27 39 11.15 119.19	8	19 57 24.852 141.128	26 00 45.45 350.88
9	18 00 14.672 155.505	27 41 10.34 108.17	9	19 59 45.980 140.708	25 54 54.57 358.92
10	18 02 50.177 155.362	27 42 58.51 97.16	10	20 02 06.688 140.287	25 48 55.65 366.90
11	18 05 25.539 155.209	27 44 35.67 86.20	11	20 04 26.975 139.864	25 42 48.75 374.79
12	18 08 00.748 155.048	27 46 01.87 75.25	12	20 06 46.839 139.439	25 36 33.96 382.59
13	18 10 35.796 154.878	27 47 17.12 64.35	13	20 09 06.278 139.013	25 30 11.37 390.32
14	18 13 10.674 154.700	27 48 21.47 53.48	14	20 11 25.291 138.585	25 23 41.05 397.96
15	18 15 45.374 154.513	27 49 14.95 42.65	15	20 13 43.876 138.157	25 17 03.09 405.52
16	18 18 19.887 154.318	27 49 57.60 31.86	16	20 16 02.033 137.726	25 10 17.57 413.00
17	18 20 54.205 154.115	27 50 29.46 21.10	17	20 18 19.759 137.296	25 03 24.57 420.39
18	18 23 28.320 153.903	27 50 50.56 -10.39	18	20 20 37.055 136.865	24 56 24.18 427.71
19	18 26 02.223 153.683	27 51 00.95 + 0.27	19	20 22 53.920 136.432	24 49 16.47 434.94
20	18 28 35.906 153.456	27 51 00.68 + 10.89	20	20 25 10.352 136.000	24 42 01.53 442.09
21	18 31 09.362 153.221	27 50 49.79 21.46	21	20 27 26.352 135.568	24 34 39.44 449.16
22	18 33 42.583 152.977	27 50 28.33 31.98	22	20 29 41.920 135.134	24 27 10.28 456.14
23	18 36 15.560 152.727	27 49 56.35 + 42.45	23	20 31 57.054 134.702	24 19 34.14 +463.05
24	18 38 48.287	-27 49 13.90	24	20 34 11.756	-24 11 51.09

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 1			May 3		
0	^{h m s} 20 34 11.756 ^a 134.269	[°] -24 11 51.09 ^a +469.87	0	^{h m s} 22 13 57.354 ^a 115.761	[°] -16 11 10.68 ^a +709.69
1	20 36 26.025 133.836	24 04 01.22 476.62	1	22 15 53.115 115.454	15 59 20.99 713.07
2	20 38 39.861 133.405	23 56 04.60 483.27	2	22 17 48.569 115.150	15 47 27.92 716.38
3	20 40 53.266 132.973	23 48 01.33 489.86	3	22 19 43.719 114.851	15 35 31.54 719.64
4	20 43 06.239 132.543	23 39 51.47 496.36	4	22 21 38.570 114.555	15 23 31.90 722.84
5	20 45 18.782 132.113	23 31 35.11 502.78	5	22 23 33.125 114.263	15 11 29.06 725.99
6	20 47 30.895 131.683	23 23 12.33 509.12	6	22 25 27.388 113.975	14 59 23.07 729.07
7	20 49 42.578 131.256	23 14 43.21 515.39	7	22 27 21.363 113.692	14 47 14.00 732.11
8	20 51 53.834 130.829	23 06 07.82 521.57	8	22 29 15.055 113.413	14 35 01.89 735.09
9	20 54 04.663 130.403	22 57 26.25 527.67	9	22 31 08.468 113.138	14 22 46.80 738.02
10	20 56 15.066 129.980	22 48 38.58 533.71	10	22 33 01.606 112.866	14 10 28.78 740.88
11	20 58 25.046 129.557	22 39 44.87 539.65	11	22 34 54.472 112.600	13 58 07.90 743.70
12	21 00 34.603 129.135	22 30 45.22 545.52	12	22 36 47.072 112.337	13 45 44.20 746.47
13	21 02 43.738 128.717	22 21 39.70 551.32	13	22 38 39.409 112.078	13 33 17.73 749.18
14	21 04 52.455 128.299	22 12 28.38 557.04	14	22 40 31.487 111.824	13 20 48.55 751.84
15	21 07 00.754 127.884	22 03 11.34 562.68	15	22 42 23.311 111.574	13 08 16.71 754.46
16	21 09 08.638 127.471	21 53 48.66 568.26	16	22 44 14.885 111.328	12 55 42.25 757.00
17	21 11 16.109 127.059	21 44 20.40 573.74	17	22 46 06.213 111.087	12 43 05.25 759.52
18	21 13 23.168 126.649	21 34 46.66 579.16	18	22 47 57.300 110.849	12 30 25.73 761.97
19	21 15 29.817 126.243	21 25 07.50 584.51	19	22 49 48.149 110.616	12 17 43.76 764.38
20	21 17 36.060 125.839	21 15 22.99 589.78	20	22 51 38.765 110.388	12 04 59.38 766.73
21	21 19 41.899 125.437	21 05 33.21 594.98	21	22 53 29.153 110.163	11 52 12.65 769.05
22	21 21 47.336 125.037	20 55 38.23 600.10	22	22 55 19.316 109.943	11 39 23.60 771.30
23	21 23 52.373 124.640	-20 45 38.13 +605.15	23	22 57 09.259 109.727	-11 26 32.30 +773.51
May 2			May 4		
0	21 25 57.013 124.247	-20 35 32.98 +610.14	0	22 58 58.986 109.515	-11 13 38.79 +775.67
1	21 28 01.260 123.855	20 25 22.84 615.05	1	23 00 48.501 109.308	11 00 43.12 777.79
2	21 30 05.115 123.466	20 15 07.79 619.90	2	23 02 37.809 109.105	10 47 45.33 779.85
3	21 32 08.581 123.081	20 04 47.89 624.66	3	23 04 26.914 108.907	10 34 45.48 781.87
4	21 34 11.662 122.699	19 54 23.23 629.36	4	23 06 15.821 108.712	10 21 43.61 783.84
5	21 36 14.361 122.319	19 43 53.87 634.00	5	23 08 04.533 108.522	10 08 39.77 785.77
6	21 38 16.680 121.943	19 33 19.87 638.57	6	23 09 53.055 108.337	9 55 34.00 787.64
7	21 40 18.623 121.569	19 22 41.30 643.06	7	23 11 41.392 108.155	9 42 26.36 789.48
8	21 42 20.192 121.200	19 11 58.24 647.49	8	23 13 29.547 107.978	9 29 16.88 791.27
9	21 44 21.392 120.833	19 01 10.75 651.85	9	23 15 17.525 107.806	9 16 05.61 793.01
10	21 46 22.225 120.469	18 50 18.90 656.16	10	23 17 05.331 107.637	9 02 52.60 794.70
11	21 48 22.694 120.110	18 39 22.74 660.38	11	23 18 52.968 107.473	8 49 37.90 796.36
12	21 50 22.804 119.753	18 28 22.36 664.56	12	23 20 40.441 107.313	8 36 21.54 797.96
13	21 52 22.557 119.401	18 17 17.80 668.65	13	23 22 27.754 107.158	8 23 03.58 799.52
14	21 54 21.958 119.051	18 06 09.15 672.70	14	23 24 14.912 107.007	8 09 44.06 801.05
15	21 56 21.009 118.705	17 54 56.45 676.67	15	23 26 01.919 106.861	7 56 23.01 802.51
16	21 58 19.714 118.363	17 43 39.78 680.59	16	23 27 48.780 106.718	7 43 00.50 803.95
17	22 00 18.077 118.025	17 32 19.19 684.44	17	23 29 35.498 106.580	7 29 36.55 805.33
18	22 02 16.102 117.690	17 20 54.75 688.22	18	23 31 22.078 106.446	7 16 11.22 806.68
19	22 04 13.792 117.359	17 09 26.53 691.95	19	23 33 08.524 106.317	7 02 44.54 807.97
20	22 06 11.151 117.032	16 57 54.58 695.63	20	23 34 54.841 106.192	6 49 16.57 809.23
21	22 08 08.183 116.708	16 46 18.95 699.23	21	23 36 41.033 106.071	6 35 47.34 810.45
22	22 10 04.891 116.389	16 34 39.72 702.77	22	23 38 27.104 105.954	6 22 16.89 811.62
23	22 12 01.280 116.074	16 22 56.95 +706.27	23	23 40 13.058 105.843	6 08 45.27 +812.74
24	22 13 57.354	-16 11 10.68	24	23 41 58.901	-5 55 12.53

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 5			May 7		
^h	^h ^m ^s	[°] ['] ["]	^h	^h ^m ^s	[°] ['] ["]
0	23 41 58.901 ^s	105.734 ^s - 5 55 12.53 ["]	0	1 05 50.649 ^s	+ 5 03 29.65 ["]
1	23 43 44.635 ^s	105.631 ^s 5 41 38.70 ["]	1	1 07 36.166 ^s	5 17 06.62 ["]
2	23 45 30.266 ^s	105.531 ^s 5 28 03.82 ["]	2	1 09 21.778 ^s	5 30 42.62 ["]
3	23 47 15.797 ^s	105.437 ^s 5 14 27.95 ["]	3	1 11 07.490 ^s	5 44 17.59 ["]
4	23 49 01.234 ^s	105.346 ^s 5 00 51.11 ["]	4	1 12 53.307 ^s	5 57 51.51 ["]
5	23 50 46.580 ^s	105.260 ^s 4 47 13.36 ["]	5	1 14 39.231 ^s	6 11 24.31 ["]
6	23 52 31.840 ^s	105.177 ^s 4 33 34.73 ["]	6	1 16 25.268 ^s	6 24 55.96 ["]
7	23 54 17.017 ^s	105.100 ^s 4 19 55.27 ["]	7	1 18 11.420 ^s	6 38 26.41 ["]
8	23 56 02.117 ^s	105.026 ^s 4 06 15.02 ["]	8	1 19 57.692 ^s	6 51 55.61 ["]
9	23 57 47.143 ^s	104.957 ^s 3 52 34.01 ["]	9	1 21 44.088 ^s	7 05 23.53 ["]
10	23 59 32.100 ^s	104.892 ^s 3 38 52.30 ["]	10	1 23 30.611 ^s	7 18 50.10 ["]
11	0 01 16.992 ^s	104.831 ^s 3 25 09.91 ["]	11	1 25 17.265 ^s	7 32 15.29 ["]
12	0 03 01.823 ^s	104.774 ^s 3 11 26.90 ["]	12	1 27 04.055 ^s	7 45 39.05 ["]
13	0 04 46.597 ^s	104.722 ^s 2 57 43.31 ["]	13	1 28 50.985 ^s	7 59 01.34 ["]
14	0 06 31.319 ^s	104.674 ^s 2 43 59.17 ["]	14	1 30 38.057 ^s	8 12 22.09 ["]
15	0 08 15.993 ^s	104.630 ^s 2 30 14.53 ["]	15	1 32 25.276 ^s	8 25 41.28 ["]
16	0 10 00.623 ^s	104.591 ^s 2 16 29.43 ["]	16	1 34 12.645 ^s	8 38 58.84 ["]
17	0 11 45.214 ^s	104.555 ^s 2 02 43.91 ["]	17	1 36 00.170 ^s	8 52 14.74 ["]
18	0 13 29.769 ^s	104.524 ^s 1 48 58.00 ["]	18	1 37 47.852 ^s	9 05 28.92 ["]
19	0 15 14.293 ^s	104.498 ^s 1 35 11.76 ["]	19	1 39 35.696 ^s	9 18 41.33 ["]
20	0 16 58.791 ^s	104.474 ^s 1 21 25.23 ["]	20	1 41 23.706 ^s	9 31 51.93 ["]
21	0 18 43.265 ^s	104.456 ^s 1 07 38.44 ["]	21	1 43 11.886 ^s	9 45 00.66 ["]
22	0 20 27.721 ^s	104.441 ^s 0 53 51.43 ["]	22	1 45 00.239 ^s	9 58 07.49 ["]
23	0 22 12.162 ^s	104.432 ^s - 0 40 04.25 ["]	23	1 46 48.769 ^s	+ 10 11 12.35 ["]
May 6			May 8		
0	0 23 56.594 ^s	104.425 ^s - 0 26 16.94 ["]	0	1 48 37.479 ^s	+ 10 24 15.20 ["]
1	0 25 41.019 ^s	104.423 ^s - 0 12 29.53 ["]	1	1 50 26.374 ^s	10 37 15.98 ["]
2	0 27 25.442 ^s	104.426 ^s + 0 01 17.92 ["]	2	1 52 15.456 ^s	10 50 14.65 ["]
3	0 29 09.868 ^s	104.432 ^s 0 15 05.38 ["]	3	1 54 04.730 ^s	11 03 11.16 ["]
4	0 30 54.300 ^s	104.443 ^s 0 28 52.81 ["]	4	1 55 54.200 ^s	11 16 05.45 ["]
5	0 32 38.743 ^s	104.458 ^s 0 42 40.16 ["]	5	1 57 43.868 ^s	11 28 57.48 ["]
6	0 34 23.201 ^s	104.476 ^s 0 56 27.40 ["]	6	1 59 33.738 ^s	11 41 47.18 ["]
7	0 36 07.677 ^s	104.500 ^s 1 10 14.47 ["]	7	2 01 23.814 ^s	11 54 34.51 ["]
8	0 37 52.177 ^s	104.527 ^s 1 24 01.35 ["]	8	2 03 14.099 ^s	12 07 19.42 ["]
9	0 39 36.704 ^s	104.558 ^s 1 37 47.99 ["]	9	2 05 04.598 ^s	12 20 01.85 ["]
10	0 41 21.262 ^s	104.594 ^s 1 51 34.34 ["]	10	2 06 55.312 ^s	12 32 41.76 ["]
11	0 43 05.856 ^s	104.633 ^s 2 05 20.36 ["]	11	2 08 46.246 ^s	12 45 19.07 ["]
12	0 44 50.489 ^s	104.676 ^s 2 19 06.02 ["]	12	2 10 37.404 ^s	12 57 53.75 ["]
13	0 46 35.165 ^s	104.725 ^s 2 32 51.27 ["]	13	2 12 28.788 ^s	13 10 25.74 ["]
14	0 48 19.890 ^s	104.776 ^s 2 46 36.06 ["]	14	2 14 20.402 ^s	13 22 54.98 ["]
15	0 50 04.666 ^s	104.832 ^s 3 00 20.36 ["]	15	2 16 12.249 ^s	13 35 21.43 ["]
16	0 51 49.498 ^s	104.891 ^s 3 14 04.12 ["]	16	2 18 04.333 ^s	13 47 45.01 ["]
17	0 53 34.389 ^s	104.956 ^s 3 27 47.30 ["]	17	2 19 56.656 ^s	14 00 05.68 ["]
18	0 55 19.345 ^s	105.024 ^s 3 41 29.85 ["]	18	2 21 49.222 ^s	14 12 23.39 ["]
19	0 57 04.369 ^s	105.096 ^s 3 55 11.74 ["]	19	2 23 42.035 ^s	14 24 38.07 ["]
20	0 58 49.465 ^s	105.172 ^s 4 08 52.92 ["]	20	2 25 35.097 ^s	14 36 49.68 ["]
21	1 00 34.637 ^s	105.252 ^s 4 22 33.34 ["]	21	2 27 28.411 ^s	14 48 58.14 ["]
22	1 02 19.889 ^s	105.336 ^s 4 36 12.97 ["]	22	2 29 21.981 ^s	15 01 03.42 ["]
23	1 04 05.225 ^s	105.424 ^s 4 49 51.75 ["]	23	2 31 15.810 ^s	15 13 05.44 ["]
24	1 05 50.649 ^s	+ 5 03 29.65 ["]	24	2 33 09.901 ^s	+ 15 25 04.15 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 9			May 11		
h	h m s	° ' "	h	h m s	° ' "
0	2 33 09.901 ^s	+15 25 04.15 ["]	0	4 10 20.133 ^s	+23 35 08.27 ["]
1	2 35 04.256 ^s	114.355	1	4 12 29.583 ^s	23 43 08.51 ["]
2	2 36 58.878 ^s	114.622	2	4 14 39.366 ^s	23 51 02.26 ["]
3	2 38 53.771 ^s	114.893	3	4 16 49.482 ^s	23 58 49.44 ["]
4	2 40 48.938 ^s	115.167	4	4 18 59.929 ^s	24 06 30.00 ["]
5	2 42 44.380 ^s	115.442	5	4 21 10.708 ^s	24 14 03.86 ["]
6	2 44 40.102 ^s	115.722	6	4 23 21.816 ^s	24 21 30.97 ["]
7	2 46 36.105 ^s	116.003	7	4 25 33.252 ^s	24 28 51.25 ["]
8	2 48 32.392 ^s	116.287	8	4 27 45.016 ^s	24 36 04.64 ["]
9	2 50 28.967 ^s	116.575	9	4 29 57.104 ^s	24 43 11.08 ["]
10	2 52 25.830 ^s	116.863	10	4 32 09.517 ^s	24 50 10.50 ["]
11	2 54 22.986 ^s	117.156	11	4 34 22.252 ^s	24 57 02.85 ["]
12	2 56 20.436 ^s	117.450	12	4 36 35.308 ^s	25 03 48.05 ["]
13	2 58 18.183 ^s	117.747	13	4 38 48.681 ^s	25 10 26.04 ["]
14	3 00 16.230 ^s	118.047	14	4 41 02.372 ^s	25 16 56.77 ["]
15	3 02 14.577 ^s	118.347	15	4 43 16.376 ^s	25 23 20.17 ["]
16	3 04 13.229 ^s	118.652	16	4 45 30.692 ^s	25 29 36.17 ["]
17	3 06 12.186 ^s	118.957	17	4 47 45.318 ^s	25 35 44.72 ["]
18	3 08 11.451 ^s	119.265	18	4 50 00.250 ^s	25 41 45.76 ["]
19	3 10 11.027 ^s	119.576	19	4 52 15.487 ^s	25 47 39.22 ["]
20	3 12 10.914 ^s	119.887	20	4 54 31.025 ^s	25 53 25.05 ["]
21	3 14 11.116 ^s	120.202	21	4 56 46.861 ^s	25 59 03.19 ["]
22	3 16 11.633 ^s	120.517	22	4 59 02.993 ^s	26 04 33.57 ["]
23	3 18 12.468 ^s	120.835	23	5 01 19.418 ^s	+26 09 56.14 ["]
		121.154			+314.71
May 10			May 12		
h	h m s	° ' "	h	h m s	° ' "
0	3 20 13.622 ^s	+19 53 25.15 ["]	0	5 03 36.131 ^s	+26 15 10.85 ["]
1	3 22 15.097 ^s	121.475	1	5 05 53.130 ^s	26 20 17.63 ["]
2	3 24 16.895 ^s	121.798	2	5 08 10.412 ^s	26 25 16.43 ["]
3	3 26 19.016 ^s	122.121	3	5 10 27.972 ^s	26 30 07.20 ["]
4	3 28 21.463 ^s	122.447	4	5 12 45.806 ^s	26 34 49.87 ["]
5	3 30 24.236 ^s	122.773	5	5 15 03.912 ^s	26 39 24.40 ["]
6	3 32 27.338 ^s	123.102	6	5 17 22.285 ^s	26 43 50.73 ["]
7	3 34 30.768 ^s	123.430	7	5 19 40.920 ^s	26 48 08.81 ["]
8	3 36 34.529 ^s	123.761	8	5 21 59.815 ^s	26 52 18.59 ["]
9	3 38 38.621 ^s	124.092	9	5 24 18.964 ^s	26 56 20.02 ["]
10	3 40 43.045 ^s	124.424	10	5 26 38.363 ^s	27 00 13.04 ["]
11	3 42 47.802 ^s	124.757	11	5 28 58.007 ^s	27 03 57.61 ["]
12	3 44 52.892 ^s	125.090	12	5 31 17.893 ^s	27 07 33.68 ["]
13	3 46 58.317 ^s	125.425	13	5 33 38.015 ^s	27 11 01.21 ["]
14	3 49 04.076 ^s	125.759	14	5 35 58.368 ^s	27 14 20.14 ["]
15	3 51 10.171 ^s	126.095	15	5 38 18.948 ^s	27 17 30.42 ["]
16	3 53 16.601 ^s	126.430	16	5 40 39.749 ^s	27 20 32.03 ["]
17	3 55 23.367 ^s	126.766	17	5 43 00.767 ^s	27 23 24.90 ["]
18	3 57 30.469 ^s	127.102	18	5 45 21.996 ^s	27 26 09.01 ["]
19	3 59 37.907 ^s	127.438	19	5 47 43.431 ^s	27 28 44.31 ["]
20	4 01 45.682 ^s	127.775	20	5 50 05.066 ^s	27 31 10.75 ["]
21	4 03 53.791 ^s	128.109	21	5 52 26.897 ^s	27 33 28.30 ["]
22	4 06 02.237 ^s	128.446	22	5 54 48.917 ^s	27 35 36.92 ["]
23	4 08 11.018 ^s	128.781	23	5 57 11.122 ^s	27 37 36.58 ["]
24	4 10 20.133 ^s	129.115	24	5 59 33.505 ^s	+27 39 27.23 ["]
		+23 35 08.27 ["]			+110.65

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 13			May 15		
h	h m s	° ' "	h	h m s	° ' "
0	5 59 33.505 ^s 142°555	+27 39 27.23 ["] +101.61	0	7 54 57.076 ^s 143°607	+26 05 00.93 ["] -347.98
1	6 01 56.060 ^s 142°722	27 41 08.84 ["] 92.55	1	7 57 20.683 ^s 143°490	25 59 12.95 ["] 357.14
2	6 04 18.782 ^s 142°883	27 42 41.39 ["] 83.44	2	7 59 44.173 ^s 143°367	25 53 15.81 ["] 366.26
3	6 06 41.665 ^s 143°038	27 44 04.83 ["] 74.30	3	8 02 07.540 ^s 143°239	25 47 09.55 ["] 375.35
4	6 09 04.703 ^s 143°187	27 45 19.13 ["] 65.14	4	8 04 30.779 ^s 143°109	25 40 54.20 ["] 384.42
5	6 11 27.890 ^s 143°330	27 46 24.27 ["] 55.94	5	8 06 53.888 ^s 142°973	25 34 29.78 ["] 393.44
6	6 13 51.220 ^s 143°467	27 47 20.21 ["] 46.73	6	8 09 16.861 ^s 142°833	25 27 56.34 ["] 402.44
7	6 16 14.687 ^s 143°597	27 48 06.94 ["] 37.47	7	8 11 39.694 ^s 142°689	25 21 13.90 ["] 411.39
8	6 18 38.284 ^s 143°722	27 48 44.41 ["] 28.21	8	8 14 02.383 ^s 142°543	25 14 22.51 ["] 420.32
9	6 21 02.006 ^s 143°840	27 49 12.62 ["] 18.90	9	8 16 24.926 ^s 142°391	25 07 22.19 ["] 429.20
10	6 23 25.846 ^s 143°952	27 49 31.52 ["] 9.59	10	8 18 47.317 ^s 142°236	25 00 12.99 ["] 438.05
11	6 25 49.798 ^s 144°057	27 49 41.11 ["] +0.25	11	8 21 09.553 ^s 142°079	24 52 54.94 ["] 446.85
12	6 28 13.855 ^s 144°157	27 49 41.36 ["] -9.12	12	8 23 31.632 ^s 141°917	24 45 28.09 ["] 455.61
13	6 30 38.012 ^s 144°249	27 49 32.24 ["] 18.49	13	8 25 53.549 ^s 141°752	24 37 52.48 ["] 464.34
14	6 33 02.261 ^s 144°336	27 49 13.75 ["] 27.89	14	8 28 15.301 ^s 141°585	24 30 08.14 ["] 473.02
15	6 35 26.597 ^s 144°416	27 48 45.86 ["] 37.30	15	8 30 36.886 ^s 141°414	24 22 15.12 ["] 481.66
16	6 37 51.013 ^s 144°490	27 48 08.56 ["] 46.73	16	8 32 58.300 ^s 141°241	24 14 13.46 ["] 490.25
17	6 40 15.503 ^s 144°557	27 47 21.83 ["] 56.17	17	8 35 19.541 ^s 141°064	24 06 03.21 ["] 498.80
18	6 42 40.060 ^s 144°618	27 46 25.66 ["] 65.62	18	8 37 40.605 ^s 140°886	23 57 44.41 ["] 507.30
19	6 45 04.678 ^s 144°673	27 45 20.04 ["] 75.09	19	8 40 01.491 ^s 140°705	23 49 17.11 ["] 515.75
20	6 47 29.351 ^s 144°720	27 44 04.95 ["] 84.55	20	8 42 22.196 ^s 140°521	23 40 41.36 ["] 524.16
21	6 49 54.071 ^s 144°763	27 42 40.40 ["] 94.04	21	8 44 42.717 ^s 140°335	23 31 57.20 ["] 532.52
22	6 52 18.834 ^s 144°797	27 41 06.36 ["] 103.52	22	8 47 03.052 ^s 140°149	23 23 04.68 ["] 540.82
23	6 54 43.631 ^s 144°826	+27 39 22.84 ["] -113.01	23	8 49 23.201 ^s 139°958	+23 14 03.86 ["] -549.09
May 14			May 16		
h	h m s	° ' "	h	h m s	° ' "
0	6 57 08.457 ^s 144°849	+27 37 29.83 ["] -122.50	0	8 51 43.159 ^s 139°767	+23 04 54.77 ["] -557.29
1	6 59 33.306 ^s 144°865	27 35 27.33 ["] 132.01	1	8 54 02.926 ^s 139°575	22 55 37.48 ["] 565.44
2	7 01 58.171 ^s 144°875	27 33 15.32 ["] 141.50	2	8 56 22.501 ^s 139°380	22 46 12.04 ["] 573.55
3	7 04 23.046 ^s 144°879	27 30 53.82 ["] 151.00	3	8 58 41.881 ^s 139°184	22 36 38.49 ["] 581.59
4	7 06 47.925 ^s 144°876	27 28 22.82 ["] 160.49	4	9 01 01.065 ^s 138°987	22 26 56.90 ["] 589.59
5	7 09 12.801 ^s 144°867	27 25 42.33 ["] 169.99	5	9 03 20.052 ^s 138°789	22 17 07.31 ["] 597.52
6	7 11 37.668 ^s 144°853	27 22 52.34 ["] 179.47	6	9 05 38.841 ^s 138°590	22 07 09.79 ["] 605.41
7	7 14 02.521 ^s 144°831	27 19 52.87 ["] 188.96	7	9 07 57.431 ^s 138°389	21 57 04.38 ["] 613.24
8	7 16 27.352 ^s 144°804	27 16 43.91 ["] 198.43	8	9 10 15.820 ^s 138°190	21 46 51.14 ["] 621.00
9	7 18 52.156 ^s 144°772	27 13 25.48 ["] 207.90	9	9 12 34.010 ^s 137°987	21 36 30.14 ["] 628.72
10	7 21 16.928 ^s 144°732	27 09 57.58 ["] 217.36	10	9 14 51.997 ^s 137°786	21 26 01.42 ["] 636.37
11	7 23 41.660 ^s 144°688	27 06 20.22 ["] 226.80	11	9 17 09.783 ^s 137°584	21 15 25.05 ["] 643.96
12	7 26 06.348 ^s 144°637	27 02 33.42 ["] 236.23	12	9 19 27.367 ^s 137°382	21 04 41.09 ["] 651.50
13	7 28 30.985 ^s 144°580	26 58 37.19 ["] 245.65	13	9 21 44.749 ^s 137°178	20 53 49.59 ["] 658.98
14	7 30 55.565 ^s 144°519	26 54 31.54 ["] 255.06	14	9 24 01.927 ^s 136°977	20 42 50.61 ["] 666.38
15	7 33 20.084 ^s 144°451	26 50 16.48 ["] 264.44	15	9 26 18.904 ^s 136°774	20 31 44.23 ["] 673.74
16	7 35 44.535 ^s 144°378	26 45 52.04 ["] 273.82	16	9 28 35.678 ^s 136°572	20 20 30.49 ["] 681.03
17	7 38 08.913 ^s 144°300	26 41 18.22 ["] 283.16	17	9 30 52.250 ^s 136°371	20 09 09.46 ["] 688.26
18	7 40 33.213 ^s 144°217	26 36 35.06 ["] 292.49	18	9 33 08.621 ^s 136°169	19 57 41.20 ["] 695.43
19	7 42 57.430 ^s 144°127	26 31 42.57 ["] 301.81	19	9 35 24.790 ^s 135°969	19 46 05.77 ["] 702.52
20	7 45 21.557 ^s 144°033	26 26 40.76 ["] 311.09	20	9 37 40.759 ^s 135°769	19 34 23.25 ["] 709.57
21	7 47 45.590 ^s 143°934	26 21 29.67 ["] 320.35	21	9 39 56.528 ^s 135°570	19 22 33.68 ["] 716.53
22	7 50 09.524 ^s 143°830	26 16 09.32 ["] 329.59	22	9 42 12.098 ^s 135°372	19 10 37.15 ["] 723.45
23	7 52 33.354 ^s 143°722	26 10 39.73 ["] -338.80	23	9 44 27.470 ^s 135°175	18 58 33.70 ["] -730.28
24	7 54 57.076 ^s	+26 05 00.93 ["]	24	9 46 42.645 ^s	+18 46 23.42 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 17			May 19		
h	h m s	° ' "	h	h m s	° ' "
0	9 46 42.645 ^s	+18 46 23.42 ["]	0	11 31 44.503 ^s	+7 11 19.40 ["]
1	9 48 57.625 ^s 134.980	18 34 06.36 ["] -737.06	1	11 33 53.257 ^s 128.754	6 55 03.24 ["] -976.16
2	9 51 12.410 ^s 134.785	18 21 42.59 ["] 743.77	2	11 36 01.977 ^s 128.720	6 38 44.07 ["] 979.17
3	9 53 27.002 ^s 134.592	18 09 12.17 ["] 750.42	3	11 38 10.667 ^s 128.690	6 22 21.97 ["] 982.10
4	9 55 41.402 ^s 134.400	17 56 35.19 ["] 756.98	4	11 40 19.331 ^s 128.664	6 05 57.03 ["] 984.94
5	9 57 55.612 ^s 134.210	17 43 51.69 ["] 763.50	5	11 42 27.975 ^s 128.644	5 49 29.33 ["] 987.70
6	10 00 09.635 ^s 134.023	17 31 01.76 ["] 769.93	6	11 44 36.603 ^s 128.628	5 32 58.96 ["] 990.37
7	10 02 23.471 ^s 133.836	17 18 05.46 ["] 776.30	7	11 46 45.221 ^s 128.618	5 16 26.03 ["] 992.93
8	10 04 37.122 ^s 133.651	17 05 02.86 ["] 782.60	8	11 48 53.832 ^s 128.611	4 59 50.60 ["] 995.43
9	10 06 50.591 ^s 133.469	16 51 54.02 ["] 788.84	9	11 51 02.443 ^s 128.611	4 43 12.78 ["] 997.82
10	10 09 03.880 ^s 133.289	16 38 39.03 ["] 794.99	10	11 53 11.058 ^s 128.615	4 26 32.65 ["] 1000.13
11	10 11 16.990 ^s 133.110	16 25 17.95 ["] 801.08	11	11 55 19.682 ^s 128.624	4 09 50.32 ["] 1002.33
12	10 13 29.925 ^s 132.935	16 11 50.85 ["] 807.10	12	11 57 28.320 ^s 128.638	3 53 05.86 ["] 1004.46
13	10 15 42.686 ^s 132.761	15 58 17.80 ["] 813.05	13	11 59 36.977 ^s 128.657	3 36 19.37 ["] 1006.49
14	10 17 55.277 ^s 132.591	15 44 38.88 ["] 818.92	14	12 01 45.658 ^s 128.681	3 19 30.94 ["] 1008.43
15	10 20 07.698 ^s 132.421	15 30 54.16 ["] 824.72	15	12 03 54.368 ^s 128.710	3 02 40.68 ["] 1010.26
16	10 22 19.955 ^s 132.257	15 17 03.70 ["] 830.46	16	12 06 03.112 ^s 128.744	2 45 48.66 ["] 1012.02
17	10 24 32.048 ^s 132.093	15 03 07.59 ["] 836.11	17	12 08 11.895 ^s 128.783	2 28 54.99 ["] 1013.67
18	10 26 43.981 ^s 131.933	14 49 05.90 ["] 841.69	18	12 10 20.723 ^s 128.828	2 11 59.76 ["] 1015.23
19	10 28 55.757 ^s 131.776	14 34 58.69 ["] 847.21	19	12 12 29.600 ^s 128.877	1 55 03.07 ["] 1016.69
20	10 31 07.378 ^s 131.621	14 20 46.05 ["] 852.64	20	12 14 38.532 ^s 128.932	1 38 05.01 ["] 1018.06
21	10 33 18.848 ^s 131.470	14 06 28.05 ["] 858.00	21	12 16 47.524 ^s 128.992	1 21 05.69 ["] 1019.32
22	10 35 30.171 ^s 131.323	13 52 04.76 ["] 863.29	22	12 18 56.581 ^s 129.057	1 04 05.19 ["] 1020.50
23	10 37 41.348 ^s 131.177	+13 37 36.26 ["] 868.50	23	12 21 05.708 ^s 129.127	+0 47 03.61 ["] 1021.58
	131.036	-873.63		129.202	-1022.55
May 18			May 20		
h	h m s	° ' "	h	h m s	° ' "
0	10 39 52.384 ^s	+13 23 02.63 ["]	0	12 23 14.910 ^s	+0 30 01.06 ["]
1	10 42 03.281 ^s 130.897	13 08 23.94 ["] -878.69	1	12 25 24.192 ^s 129.282	+0 12 57.63 ["] -1023.43
2	10 44 14.044 ^s 130.763	12 53 40.27 ["] 883.67	2	12 27 33.560 ^s 129.368	-0 04 06.58 ["] 1024.21
3	10 46 24.676 ^s 130.632	12 38 51.69 ["] 888.58	3	12 29 43.019 ^s 129.459	-0 21 11.47 ["] 1024.89
4	10 48 35.180 ^s 130.504	12 23 58.29 ["] 893.40	4	12 31 52.574 ^s 129.555	0 38 16.93 ["] 1025.46
5	10 50 45.560 ^s 130.380	12 09 00.13 ["] 898.16	5	12 34 02.231 ^s 129.657	0 55 22.87 ["] 1025.94
6	10 52 55.820 ^s 130.260	11 53 57.31 ["] 902.82	6	12 36 11.993 ^s 129.762	1 12 29.18 ["] 1026.31
7	10 55 05.963 ^s 130.143	11 38 49.89 ["] 907.42	7	12 38 21.867 ^s 129.874	1 29 35.76 ["] 1026.58
8	10 57 15.994 ^s 130.031	11 23 37.96 ["] 911.93	8	12 40 31.858 ^s 129.991	1 46 42.51 ["] 1026.75
9	10 59 25.916 ^s 129.922	11 08 21.60 ["] 916.36	9	12 42 41.971 ^s 130.113	2 03 49.33 ["] 1026.82
10	11 01 35.733 ^s 129.817	10 53 00.88 ["] 920.72	10	12 44 52.210 ^s 130.239	2 20 56.11 ["] 1026.78
11	11 03 45.449 ^s 129.716	10 37 35.89 ["] 924.99	11	12 47 02.582 ^s 130.372	2 38 02.74 ["] 1026.63
12	11 05 55.068 ^s 129.619	10 22 06.71 ["] 929.18	12	12 49 13.091 ^s 130.509	2 55 09.12 ["] 1026.38
13	11 08 04.595 ^s 129.527	10 06 33.41 ["] 933.30	13	12 51 23.743 ^s 130.652	3 12 15.15 ["] 1026.03
14	11 10 14.033 ^s 129.438	9 50 56.08 ["] 937.33	14	12 53 34.543 ^s 130.800	3 29 20.72 ["] 1025.57
15	11 12 23.387 ^s 129.354	9 35 14.81 ["] 941.27	15	12 55 45.495 ^s 130.952	3 46 25.71 ["] 1024.99
16	11 14 32.661 ^s 129.274	9 19 29.67 ["] 945.14	16	12 57 56.604 ^s 131.109	4 03 30.04 ["] 1024.33
17	11 16 41.859 ^s 129.198	9 03 40.74 ["] 948.93	17	13 00 07.877 ^s 131.273	4 20 33.57 ["] 1023.53
18	11 18 50.987 ^s 129.128	8 47 48.12 ["] 952.62	18	13 02 19.317 ^s 131.440	4 37 36.21 ["] 1022.64
19	11 21 00.047 ^s 129.060	8 31 51.88 ["] 956.24	19	13 04 30.931 ^s 131.614	4 54 37.86 ["] 1021.65
20	11 23 09.045 ^s 128.998	8 15 52.11 ["] 959.77	20	13 06 42.722 ^s 131.791	5 11 38.38 ["] 1020.52
21	11 25 17.985 ^s 128.940	7 59 48.89 ["] 963.22	21	13 08 54.695 ^s 131.973	5 28 37.69 ["] 1019.31
22	11 27 26.871 ^s 128.886	7 43 42.31 ["] 966.58	22	13 11 06.857 ^s 132.162	5 45 35.66 ["] 1017.97
23	11 29 35.709 ^s 128.838	7 27 32.45 ["] 969.86	23	13 13 19.211 ^s 132.354	6 02 32.18 ["] 1016.52
24	11 31 44.503 ^s 128.794	+7 11 19.40 ["] -973.05	24	13 15 31.762 ^s 132.551	-6 19 27.15 ["] -1014.97

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
May 21			May 23		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	13 15 31.762	132.754	0	15 06 46.501	146.763
1	13 17 44.516	132.961	1	15 09 13.264	147.101
2	13 19 57.477	133.172	2	15 11 40.365	147.438
3	13 22 10.649	133.389	3	15 14 07.803	147.774
4	13 24 24.038	133.610	4	15 16 35.577	148.109
5	13 26 37.648	133.836	5	15 19 03.686	148.443
6	13 28 51.484	134.066	6	15 21 32.129	148.776
7	13 31 05.550	134.301	7	15 24 00.905	149.107
8	13 33 19.851	134.540	8	15 26 30.012	149.436
9	13 35 34.391	134.783	9	15 28 59.448	149.764
10	13 37 49.174	135.032	10	15 31 29.212	150.088
11	13 40 04.206	135.283	11	15 33 59.300	150.412
12	13 42 19.489	135.541	12	15 36 29.712	150.732
13	13 44 35.030	135.800	13	15 39 00.444	151.049
14	13 46 50.830	136.065	14	15 41 31.493	151.364
15	13 49 06.895	136.334	15	15 44 02.857	151.675
16	13 51 23.229	136.606	16	15 46 34.532	151.983
17	13 53 39.835	136.883	17	15 49 06.515	152.287
18	13 55 56.718	137.162	18	15 51 38.802	152.587
19	13 58 13.880	137.446	19	15 54 11.389	152.883
20	14 00 31.326	137.734	20	15 56 44.272	153.176
21	14 02 49.060	138.024	21	15 59 17.448	153.463
22	14 05 07.084	138.318	22	16 01 50.911	153.746
23	14 07 25.402	138.616	23	16 04 24.657	154.023
May 22			May 24		
0	14 09 44.018	138.916	0	16 06 58.680	154.297
1	14 12 02.934	139.220	1	16 09 32.977	154.564
2	14 14 22.154	139.526	2	16 12 07.541	154.826
3	14 16 41.680	139.836	3	16 14 42.367	155.082
4	14 19 01.516	140.148	4	16 17 17.449	155.332
5	14 21 21.664	140.463	5	16 19 52.781	155.576
6	14 23 42.127	140.781	6	16 22 28.357	155.814
7	14 26 02.908	141.100	7	16 25 04.171	156.045
8	14 28 24.008	141.422	8	16 27 40.216	156.269
9	14 30 45.430	141.746	9	16 30 16.485	156.486
10	14 33 07.176	142.072	10	16 32 52.971	156.696
11	14 35 29.248	142.400	11	16 35 29.667	156.900
12	14 37 51.648	142.730	12	16 38 06.567	157.094
13	14 40 14.378	143.061	13	16 40 43.661	157.283
14	14 42 37.439	143.393	14	16 43 20.944	157.462
15	14 45 00.832	143.728	15	16 45 58.406	157.633
16	14 47 24.560	144.063	16	16 48 36.039	157.797
17	14 49 48.623	144.398	17	16 51 13.836	157.952
18	14 52 13.021	144.735	18	16 53 51.788	158.099
19	14 54 37.756	145.073	19	16 56 29.887	158.236
20	14 57 02.829	145.411	20	16 59 08.123	158.365
21	14 59 28.240	145.749	21	17 01 46.488	158.485
22	15 01 53.989	146.087	22	17 04 24.973	158.595
23	15 04 20.076	146.425	23	17 07 03.568	158.697
24	15 06 46.501		24	17 09 42.265	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
May 25									May 27								
h	m	s	°	'	°	'	"	h	m	s	°	'	"	°	'	"	
0	17	09	42.265	158.790	-26	27	32.60	0	19	15	24.336	151.628	-27	16	07.95	+204.84	
1	17	12	21.055	158.872	26	32	59.44	1	19	17	55.964	151.264	27	12	43.11	214.73	
2	17	14	59.927	158.945	26	38	14.93	2	19	20	27.228	150.894	27	09	08.38	224.56	
3	17	17	38.872	159.009	26	43	19.05	3	19	22	58.122	150.518	27	05	23.82	234.30	
4	17	20	17.881	159.062	26	48	11.76	4	19	25	28.640	150.136	27	01	29.52	243.97	
5	17	22	56.943	159.105	26	52	53.06	5	19	27	58.776	149.747	26	57	25.55	253.54	
6	17	25	36.048	159.140	26	57	22.91	6	19	30	28.523	149.354	26	53	12.01	263.04	
7	17	28	15.188	159.163	27	01	41.30	7	19	32	57.877	148.955	26	48	48.97	272.46	
8	17	30	54.351	159.176	27	05	48.21	8	19	35	26.832	148.550	26	44	16.51	281.78	
9	17	33	33.527	159.180	27	09	43.64	9	19	37	55.382	148.142	26	39	34.73	291.03	
10	17	36	12.707	159.173	27	13	27.58	10	19	40	23.524	147.728	26	34	43.70	300.19	
11	17	38	51.880	159.155	27	17	00.01	11	19	42	51.252	147.309	26	29	43.51	309.26	
12	17	41	31.035	159.129	27	20	20.94	12	19	45	18.561	146.887	26	24	34.25	318.25	
13	17	44	10.164	159.090	27	23	30.36	13	19	47	45.448	146.460	26	19	16.00	327.14	
14	17	46	49.254	159.043	27	26	28.27	14	19	50	11.908	146.030	26	13	48.86	335.95	
15	17	49	28.297	158.984	27	29	14.69	15	19	52	37.938	145.595	26	08	12.91	344.66	
16	17	52	07.281	158.915	27	31	49.61	16	19	55	03.533	145.158	26	02	28.25	353.30	
17	17	54	46.196	158.836	27	34	13.04	17	19	57	28.691	144.716	25	56	34.95	361.83	
18	17	57	25.032	158.747	27	36	25.01	18	19	59	53.407	144.272	25	50	33.12	370.28	
19	18	00	03.779	158.647	27	38	25.51	19	20	02	17.679	143.825	25	44	22.84	378.64	
20	18	02	42.426	158.536	27	40	14.57	20	20	04	41.504	143.376	25	38	04.20	386.91	
21	18	05	20.962	158.417	27	41	52.22	21	20	07	04.880	142.923	25	31	37.29	395.07	
22	18	07	59.379	158.286	27	43	18.46	22	20	09	27.803	142.469	25	25	02.22	403.16	
23	18	10	37.665	158.145	-27	44	33.33	23	20	11	50.272	142.012	-25	18	19.06	+411.15	
May 26									May 28								
0	18	13	15.810	157.994	-27	45	36.85	0	20	14	12.284	141.553	-25	11	27.91	+419.05	
1	18	15	53.804	157.833	27	46	29.06	1	20	16	33.837	141.093	25	04	28.86	426.85	
2	18	18	31.637	157.663	27	47	09.98	2	20	18	54.930	140.632	24	57	22.01	434.56	
3	18	21	09.300	157.482	27	47	39.65	3	20	21	15.562	140.168	24	50	07.45	442.19	
4	18	23	46.782	157.292	27	47	58.11	4	20	23	35.730	139.705	24	42	45.26	449.71	
5	18	26	24.074	157.091	27	48	05.39	5	20	25	55.435	139.239	24	35	15.55	457.15	
6	18	29	01.165	156.883	27	48	01.54	6	20	28	14.674	138.773	24	27	38.40	464.49	
7	18	31	38.048	156.663	27	47	46.59	7	20	30	33.447	138.306	24	19	53.91	471.75	
8	18	34	14.711	156.434	27	47	20.61	8	20	32	51.753	137.839	24	12	02.16	478.90	
9	18	36	51.145	156.197	27	46	43.63	9	20	35	09.592	137.372	24	04	03.26	485.97	
10	18	39	27.342	155.951	27	45	55.70	10	20	37	26.964	136.905	23	55	57.29	492.95	
11	18	42	03.293	155.695	27	44	56.88	11	20	39	43.869	136.437	23	47	44.34	499.84	
12	18	44	38.988	155.430	27	43	47.21	12	20	42	00.306	135.970	23	39	24.50	506.62	
13	18	47	14.418	155.157	27	42	26.77	13	20	44	16.276	135.503	23	30	57.88	513.33	
14	18	49	49.575	154.875	27	40	55.59	14	20	46	31.779	135.036	23	22	24.55	519.95	
15	18	52	24.450	154.586	27	39	13.75	15	20	48	46.815	134.571	23	13	44.60	526.47	
16	18	54	59.036	154.287	27	37	21.31	16	20	51	01.386	134.107	23	04	58.13	532.90	
17	18	57	33.323	153.982	27	35	18.33	17	20	53	15.493	133.642	22	56	05.23	539.24	
18	19	00	07.305	153.667	27	33	04.86	18	20	55	29.135	133.180	22	47	05.99	545.50	
19	19	02	40.972	153.345	27	30	40.99	19	20	57	42.315	132.718	22	38	00.49	551.67	
20	19	05	14.317	153.017	27	28	06.78	20	20	59	55.033	132.257	22	28	48.82	557.75	
21	19	07	47.334	152.680	27	25	22.30	21	21	02	07.290	131.800	22	19	31.07	563.74	
22	19	10	20.014	152.336	27	22	27.62	22	21	04	19.090	131.342	22	10	07.33	569.64	
23	19	12	52.350	151.986	27	19	22.81	23	21	06	30.432	130.887	22	00	37.69	+575.46	
24	19	15	24.336		-27	16	07.95	24	21	08	41.319		-21	51	02.23		

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
May 29									May 31								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	21	08	41.319	130.433	-21	51	02.23	+581.20	0	22	45	26.382	112.540	-12	42	11.81	+768.17
1	21	10	51.752	129.982	21	41	21.03	586.84	1	22	47	18.922	112.269	12	29	23.64	770.50
2	21	13	01.734	129.533	21	31	34.19	592.41	2	22	49	11.191	112.003	12	16	33.14	772.77
3	21	15	11.267	129.086	21	21	41.78	597.89	3	22	51	03.194	111.743	12	03	40.37	775.00
4	21	17	20.353	128.642	21	11	43.89	603.28	4	22	52	54.937	111.485	11	50	45.37	777.17
5	21	19	28.995	128.199	21	01	40.61	608.59	5	22	54	46.422	111.235	11	37	48.20	779.28
6	21	21	37.194	127.759	20	51	32.02	613.83	6	22	56	37.657	110.987	11	24	48.92	781.36
7	21	23	44.953	127.322	20	41	18.19	618.97	7	22	58	28.644	110.744	11	11	47.56	783.38
8	21	25	52.275	126.888	20	30	59.22	624.04	8	23	00	19.388	110.507	10	58	44.18	785.34
9	21	27	59.163	126.456	20	20	35.18	629.03	9	23	02	09.895	110.274	10	45	38.84	787.26
10	21	30	05.619	126.028	20	10	06.15	633.93	10	23	04	00.169	110.046	10	32	31.58	789.13
11	21	32	11.647	125.602	19	59	32.22	638.77	11	23	05	50.215	109.822	10	19	22.45	790.94
12	21	34	17.249	125.180	19	48	53.45	643.51	12	23	07	40.037	109.604	10	06	11.51	792.72
13	21	36	22.429	124.761	19	38	09.94	648.19	13	23	09	29.641	109.390	9	52	58.79	794.44
14	21	38	27.190	124.345	19	27	21.75	652.79	14	23	11	19.031	109.180	9	39	44.35	796.11
15	21	40	31.535	123.931	19	16	28.96	657.30	15	23	13	08.211	108.975	9	26	28.24	797.75
16	21	42	35.466	123.523	19	05	31.66	661.75	16	23	14	57.186	108.776	9	13	10.49	799.32
17	21	44	38.989	123.117	18	54	29.91	666.11	17	23	16	45.962	108.581	8	59	51.17	800.86
18	21	46	42.106	122.714	18	43	23.80	670.41	18	23	18	34.543	108.390	8	46	30.31	802.34
19	21	48	44.820	122.316	18	32	13.39	674.63	19	23	20	22.933	108.205	8	33	07.97	803.79
20	21	50	47.136	121.921	18	20	58.76	678.78	20	23	22	11.138	108.024	8	19	44.18	805.19
21	21	52	49.057	121.530	18	09	39.98	682.86	21	23	23	59.162	107.847	8	06	18.99	806.54
22	21	54	50.587	121.142	17	58	17.12	686.86	22	23	25	47.009	107.677	7	52	52.45	807.85
23	21	56	51.729	120.758	-17	46	50.26	+690.80	23	23	27	34.686	107.509	-7	39	24.60	+809.11
May 30									June 1								
0	21	58	52.487	120.379	-17	35	19.46	+694.66	0	23	29	22.195	107.348	-7	25	55.49	+810.33
1	22	00	52.866	120.003	17	23	44.80	698.46	1	23	31	09.543	107.190	7	12	25.16	811.51
2	22	02	52.869	119.631	17	12	06.34	702.18	2	23	32	56.733	107.038	6	58	53.65	812.64
3	22	04	52.500	119.264	17	00	24.16	705.84	3	23	34	43.771	106.890	6	45	21.01	813.73
4	22	06	51.764	118.900	16	48	38.32	709.43	4	23	36	30.661	106.746	6	31	47.28	814.78
5	22	08	50.664	118.540	16	36	48.89	712.96	5	23	38	17.407	106.609	6	18	12.50	815.79
6	22	10	49.204	118.186	16	24	55.93	716.42	6	23	40	04.016	106.475	6	04	36.71	816.75
7	22	12	47.390	117.834	16	12	59.51	719.81	7	23	41	50.491	106.345	5	50	59.96	817.67
8	22	14	45.224	117.487	16	00	59.70	723.14	8	23	43	36.836	106.222	5	37	22.29	818.55
9	22	16	42.711	117.144	15	48	56.56	726.40	9	23	45	23.058	106.102	5	23	43.74	819.38
10	22	18	39.855	116.807	15	36	50.16	729.61	10	23	47	09.160	105.987	5	10	04.36	820.19
11	22	20	36.662	116.472	15	24	40.55	732.75	11	23	48	55.147	105.877	4	56	24.17	820.94
12	22	22	33.134	116.143	15	12	27.80	735.82	12	23	50	41.024	105.771	4	42	43.23	821.66
13	22	24	29.277	115.818	15	00	11.98	738.84	13	23	52	26.795	105.670	4	29	01.57	822.33
14	22	26	25.095	115.497	14	47	53.14	741.80	14	23	54	12.465	105.575	4	15	19.24	822.96
15	22	28	20.592	115.181	14	35	31.34	744.70	15	23	55	58.040	105.482	4	01	36.28	823.56
16	22	30	15.773	114.870	14	23	06.64	747.53	16	23	57	43.522	105.396	3	47	52.72	824.12
17	22	32	10.643	114.562	14	10	39.11	750.31	17	23	59	28.918	105.314	3	34	08.60	824.63
18	22	34	05.205	114.259	13	58	08.80	753.03	18	0	01	14.232	105.236	3	20	23.97	825.10
19	22	35	59.464	113.962	13	45	35.77	755.69	19	0	02	59.468	105.163	3	06	38.87	825.54
20	22	37	53.426	113.668	13	33	00.08	758.30	20	0	04	44.631	105.094	2	52	53.33	825.93
21	22	39	47.094	113.379	13	20	21.78	760.85	21	0	06	29.725	105.031	2	39	07.40	826.30
22	22	41	40.473	113.094	13	07	40.93	763.34	22	0	08	14.756	104.972	2	25	21.10	826.60
23	22	43	33.567	112.815	12	54	57.59	+765.78	23	0	09	59.728	104.917	2	11	34.50	+826.89
24	22	45	26.382		-12	42	11.81		24	0	11	44.645		-1	57	47.61	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 2			June 4		
^h 0	^h 0 ^m 11 ^s 44.645 ^s 104.868	— 1 57 47.61	^h 0	^h 1 36 05.073 ^s 107.733	+ 8 56 19.54
1	0 13 29.513 104.822	1 44 00.49	1	1 37 52.806 107.898	9 09 31.39
2	0 15 14.335 104.782	1 30 13.17	2	1 39 40.704 108.068	9 22 41.46
3	0 16 59.117 104.745	1 16 25.68	3	1 41 28.772 108.241	9 35 49.72
4	0 18 43.862 104.714	1 02 38.08	4	1 43 17.013 108.419	9 48 56.12
5	0 20 28.576 104.687	0 48 50.39	5	1 45 05.432 108.601	10 02 00.61
6	0 22 13.263 104.664	0 35 02.66	6	1 46 54.033 108.787	10 15 03.14
7	0 23 57.927 104.647	0 21 14.92	7	1 48 42.820 108.977	10 28 03.67
8	0 25 42.574 104.633	— 0 07 27.21	8	1 50 31.797 109.170	10 41 02.15
9	0 27 27.207 104.625	+ 0 06 20.42	9	1 52 20.967 109.368	10 53 58.52
10	0 29 11.832 104.620	0 20 07.94	10	1 54 10.335 109.570	11 06 52.74
11	0 30 56.452 104.620	0 33 55.31	11	1 55 59.905 109.776	11 19 44.76
12	0 32 41.072 104.626	0 47 42.49	12	1 57 49.681 109.986	11 32 34.54
13	0 34 25.698 104.634	1 01 29.44	13	1 59 39.667 110.199	11 45 22.01
14	0 36 10.332 104.649	1 15 16.13	14	2 01 29.866 110.416	11 58 07.14
15	0 37 54.981 104.666	1 29 02.51	15	2 03 20.282 110.638	12 10 49.86
16	0 39 39.647 104.690	1 42 48.54	16	2 05 10.920 110.863	12 23 30.14
17	0 41 24.337 104.716	1 56 34.20	17	2 07 01.783 111.091	12 36 07.91
18	0 43 09.053 104.749	2 10 19.42	18	2 08 52.874 111.324	12 48 43.12
19	0 44 53.802 104.784	2 24 04.19	19	2 10 44.198 111.561	13 01 15.73
20	0 46 38.586 104.825	2 37 48.46	20	2 12 35.759 111.801	13 13 45.67
21	0 48 23.411 104.871	2 51 32.18	21	2 14 27.560 112.044	13 26 12.91
22	0 50 08.282 104.919	3 05 15.32	22	2 16 19.604 112.292	13 38 37.37
23	0 51 53.201 104.974	+ 3 18 57.84	23	2 18 11.896 112.543	+ 13 50 59.02
June 3			June 5		
0	0 53 38.175 105.032	+ 3 32 39.71	0	2 20 04.439 112.797	+ 14 03 17.78
1	0 55 23.207 105.095	3 46 20.87	1	2 21 57.236 113.056	14 15 33.62
2	0 57 08.302 105.162	4 00 01.29	2	2 23 50.292 113.317	14 27 46.47
3	0 58 53.464 105.234	4 13 40.93	3	2 25 43.609 113.582	14 39 56.28
4	1 00 38.698 105.309	4 27 19.75	4	2 27 37.191 113.851	14 52 02.99
5	1 02 24.007 105.390	4 40 57.71	5	2 29 31.042 114.122	15 04 06.55
6	1 04 09.397 105.474	4 54 34.76	6	2 31 25.164 114.398	15 16 06.90
7	1 05 54.871 105.564	5 08 10.87	7	2 33 19.562 114.677	15 28 03.97
8	1 07 40.435 105.657	5 21 46.00	8	2 35 14.239 114.958	15 39 57.72
9	1 09 26.092 105.755	5 35 20.10	9	2 37 09.197 115.243	15 51 48.08
10	1 11 11.847 105.856	5 48 53.13	10	2 39 04.440 115.532	16 03 35.00
11	1 12 57.703 105.963	6 02 25.05	11	2 40 59.972 115.823	16 15 18.42
12	1 14 43.666 106.074	6 15 55.82	12	2 42 55.795 116.117	16 26 58.27
13	1 16 29.740 106.189	6 29 25.40	13	2 44 51.912 116.415	16 38 34.50
14	1 18 15.929 106.308	6 42 53.74	14	2 46 48.327 116.715	16 50 07.05
15	1 20 02.237 106.431	6 56 20.80	15	2 48 45.042 117.018	17 01 35.85
16	1 21 48.668 106.559	7 09 46.53	16	2 50 42.060 117.325	17 13 00.85
17	1 23 35.227 106.691	7 23 10.90	17	2 52 39.385 117.633	17 24 21.98
18	1 25 21.918 106.828	7 36 33.86	18	2 54 37.018 117.946	17 35 39.18
19	1 27 08.746 106.968	7 49 55.37	19	2 56 34.964 118.260	17 46 52.39
20	1 28 55.714 107.112	8 03 15.38	20	2 58 33.224 118.577	17 58 01.55
21	1 30 42.826 107.261	8 16 33.84	21	3 00 31.801 118.896	18 09 06.59
22	1 32 30.087 107.415	8 29 50.72	22	3 02 30.697 119.219	18 20 07.44
23	1 34 17.502 107.571	8 43 05.97	23	3 04 29.916 119.543	18 31 04.05
24	1 36 05.073	+ 8 56 19.54	24	3 06 29.459	+ 18 41 56.35

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
June 6							June 8						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	3 06	29.459	^s 119.870	+18 41	56.35	+647.93	0	4 48	55.727	^s 136.563	+25 37	07.57	["] +357.31
1	3 08	29.329	120.200	18 52	44.28	643.49	1	4 51	12.290	136.885	25 43	04.88	349.57
2	3 10	29.529	120.531	19 03	27.77	638.98	2	4 53	29.175	137.204	25 48	54.45	341.77
3	3 12	30.060	120.865	19 14	06.75	634.40	3	4 55	46.379	137.521	25 54	36.22	333.99
4	3 14	30.925	121.200	19 24	41.15	629.78	4	4 58	03.900	137.833	26 00	10.12	325.97
5	3 16	32.125	121.538	19 35	10.93	625.06	5	5 00	21.733	138.142	26 05	36.09	317.98
6	3 18	33.663	121.878	19 45	35.99	620.30	6	5 02	39.875	138.447	26 10	54.07	309.92
7	3 20	35.541	122.220	19 55	56.29	615.46	7	5 04	58.322	138.748	26 16	03.99	301.81
8	3 22	37.761	122.562	20 06	11.75	610.55	8	5 07	17.070	139.046	26 21	05.80	293.62
9	3 24	40.323	122.908	20 16	22.30	605.58	9	5 09	36.116	139.338	26 25	59.42	285.39
10	3 26	43.231	123.254	20 26	27.88	600.54	10	5 11	55.454	139.628	26 30	44.81	277.10
11	3 28	46.485	123.602	20 36	28.42	595.43	11	5 14	15.082	139.912	26 35	21.91	268.74
12	3 30	50.087	123.951	20 46	23.85	590.25	12	5 16	34.994	140.192	26 39	50.65	260.33
13	3 32	54.038	124.302	20 56	14.10	585.01	13	5 18	55.186	140.468	26 44	10.98	251.87
14	3 34	58.340	124.654	21 05	59.11	579.68	14	5 21	15.654	140.738	26 48	22.85	243.34
15	3 37	02.994	125.007	21 15	38.79	574.31	15	5 23	36.392	141.003	26 52	26.19	234.77
16	3 39	08.001	125.362	21 25	13.10	568.84	16	5 25	57.395	141.264	26 56	20.96	226.13
17	3 41	13.363	125.716	21 34	41.94	563.33	17	5 28	18.659	141.520	27 00	07.09	217.46
18	3 43	19.079	126.072	21 44	05.27	557.73	18	5 30	40.179	141.769	27 03	44.55	208.72
19	3 45	25.151	126.429	21 53	23.00	552.06	19	5 33	01.948	142.014	27 07	13.27	199.93
20	3 47	31.580	126.786	22 02	35.06	546.33	20	5 35	23.962	142.253	27 10	33.20	191.11
21	3 49	38.366	127.144	22 11	41.39	540.52	21	5 37	46.215	142.486	27 13	44.31	182.22
22	3 51	45.510	127.502	22 20	41.91	534.65	22	5 40	08.701	142.714	27 16	46.53	173.29
23	3 53	53.012	127.860	+22 29	36.56	+528.71	23	5 42	31.415	142.936	+27 19	39.82	+164.32
June 7							June 9						
0	3 56	00.872	128.219	+22 38	25.27	+522.68	0	5 44	54.351	143.152	+27 22	24.14	+155.31
1	3 58	09.091	128.578	22 47	07.95	516.60	1	5 47	17.503	143.362	27 24	59.45	146.24
2	4 00	17.669	128.936	22 55	44.55	510.45	2	5 49	40.865	143.566	27 27	25.69	137.13
3	4 02	26.605	129.295	23 04	15.00	504.21	3	5 52	04.431	143.763	27 29	42.82	128.00
4	4 04	35.900	129.653	23 12	39.21	497.91	4	5 54	28.194	143.954	27 31	50.82	118.80
5	4 06	45.553	130.011	23 20	57.12	491.55	5	5 56	52.148	144.139	27 33	49.62	109.59
6	4 08	55.564	130.368	23 29	08.67	485.11	6	5 59	16.287	144.316	27 35	39.21	100.33
7	4 11	05.932	130.725	23 37	13.78	478.59	7	6 01	40.603	144.489	27 37	19.54	91.03
8	4 13	16.657	131.081	23 45	12.37	472.01	8	6 04	05.092	144.653	27 38	50.57	81.71
9	4 15	27.738	131.435	23 53	04.38	465.37	9	6 06	29.745	144.812	27 40	12.28	72.34
10	4 17	39.173	131.790	24 00	49.75	458.64	10	6 08	54.557	144.962	27 41	24.62	62.95
11	4 19	50.963	132.142	24 08	28.39	451.85	11	6 11	19.519	145.107	27 42	27.57	53.53
12	4 22	03.105	132.494	24 16	00.24	444.99	12	6 13	44.626	145.245	27 43	21.10	44.08
13	4 24	15.599	132.843	24 23	25.23	438.05	13	6 16	09.871	145.376	27 44	05.18	34.60
14	4 26	28.442	133.193	24 30	43.28	431.06	14	6 18	35.247	145.498	27 44	39.78	25.09
15	4 28	41.635	133.539	24 37	54.34	423.99	15	6 21	00.745	145.616	27 45	04.87	15.57
16	4 30	55.174	133.884	24 44	58.33	416.85	16	6 23	26.361	145.724	27 45	20.44	6.02
17	4 33	09.058	134.228	24 51	55.18	409.65	17	6 25	52.085	145.826	27 45	26.46	3.55
18	4 35	23.286	134.568	24 58	44.83	402.37	18	6 28	17.911	145.922	27 45	22.91	13.13
19	4 37	37.854	134.907	25 05	27.20	395.02	19	6 30	43.833	146.009	27 45	09.78	22.75
20	4 39	52.761	135.243	25 12	02.22	387.62	20	6 33	09.842	146.089	27 44	47.03	32.37
21	4 42	08.004	135.578	25 18	29.84	380.14	21	6 35	35.931	146.163	27 44	14.66	42.01
22	4 44	23.582	135.908	25 24	49.98	372.60	22	6 38	02.094	146.228	27 43	32.65	51.65
23	4 46	39.490	136.237	25 31	02.58	+364.99	23	6 40	28.322	146.287	27 42	41.00	61.32
24	4 48	55.727		+25 37	07.57		24	6 42	54.609		+27 41	39.68	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 10			June 12		
0	6 42 54.609 ^s	+27 41 39.68 ["]	0	8 38 52.028 ^s	+23 46 03.78 ["]
1	6 45 20.947 ^s	27 40 28.68 ["]	1	8 41 13.285 ^s	23 37 27.34 ["]
2	6 47 47.329 ^s	27 39 08.01 ["]	2	8 43 34.319 ^s	23 28 42.57 ["]
3	6 50 13.748 ^s	27 37 37.65 ["]	3	8 45 55.129 ^s	23 19 49.54 ["]
4	6 52 40.196 ^s	27 35 57.60 ["]	4	8 48 15.713 ^s	23 10 48.30 ["]
5	6 55 06.666 ^s	27 34 07.85 ["]	5	8 50 36.066 ^s	23 01 38.92 ["]
6	6 57 33.151 ^s	27 32 08.41 ["]	6	8 52 56.189 ^s	22 52 21.45 ["]
7	6 59 59.643 ^s	27 29 59.27 ["]	7	8 55 16.078 ^s	22 42 55.96 ["]
8	7 02 26.136 ^s	27 27 40.43 ["]	8	8 57 35.733 ^s	22 33 22.50 ["]
9	7 04 52.622 ^s	27 25 11.90 ["]	9	8 59 55.150 ^s	22 23 41.14 ["]
10	7 07 19.094 ^s	27 22 33.68 ["]	10	9 02 14.330 ^s	22 13 51.95 ["]
11	7 09 45.546 ^s	27 19 45.79 ["]	11	9 04 33.270 ^s	22 03 54.99 ["]
12	7 12 11.969 ^s	27 16 48.21 ["]	12	9 06 51.968 ^s	21 53 50.31 ["]
13	7 14 38.357 ^s	27 13 40.98 ["]	13	9 09 10.425 ^s	21 43 38.00 ["]
14	7 17 04.704 ^s	27 10 24.09 ["]	14	9 11 28.640 ^s	21 33 18.11 ["]
15	7 19 31.002 ^s	27 06 57.56 ["]	15	9 13 46.610 ^s	21 22 50.71 ["]
16	7 21 57.244 ^s	27 03 21.40 ["]	16	9 16 04.336 ^s	21 12 15.87 ["]
17	7 24 23.424 ^s	26 59 35.63 ["]	17	9 18 21.818 ^s	21 01 33.65 ["]
18	7 26 49.535 ^s	26 55 40.27 ["]	18	9 20 39.054 ^s	20 50 44.13 ["]
19	7 29 15.571 ^s	26 51 35.34 ["]	19	9 22 56.045 ^s	20 39 47.36 ["]
20	7 31 41.525 ^s	26 47 20.85 ["]	20	9 25 12.790 ^s	20 28 43.43 ["]
21	7 34 07.391 ^s	26 42 56.83 ["]	21	9 27 29.290 ^s	20 17 32.41 ["]
22	7 36 33.162 ^s	26 38 23.30 ["]	22	9 29 45.545 ^s	20 06 14.35 ["]
23	7 38 58.833 ^s	+26 33 40.29 ["]	23	9 32 01.554 ^s	+19 54 49.33 ["]
	145.564	-292.47		135.765	-691.90
June 11			June 13		
0	7 41 24.397 ^s	+26 28 47.82 ["]	0	9 34 17.319 ^s	+19 43 17.43 ["]
1	7 43 49.847 ^s	26 23 45.92 ["]	1	9 36 32.840 ^s	19 31 38.71 ["]
2	7 46 15.179 ^s	26 18 34.62 ["]	2	9 38 48.118 ^s	19 19 53.25 ["]
3	7 48 40.387 ^s	26 13 13.95 ["]	3	9 41 03.152 ^s	19 08 01.12 ["]
4	7 51 05.464 ^s	26 07 43.95 ["]	4	9 43 17.946 ^s	18 56 02.39 ["]
5	7 53 30.405 ^s	26 02 04.64 ["]	5	9 45 32.498 ^s	18 43 57.13 ["]
6	7 55 55.206 ^s	25 56 16.06 ["]	6	9 47 46.811 ^s	18 31 45.42 ["]
7	7 58 19.859 ^s	25 50 18.25 ["]	7	9 50 00.886 ^s	18 19 27.32 ["]
8	8 00 44.361 ^s	25 44 11.24 ["]	8	9 52 14.725 ^s	18 07 02.93 ["]
9	8 03 08.707 ^s	25 37 55.07 ["]	9	9 54 28.328 ^s	17 54 32.29 ["]
10	8 05 32.890 ^s	25 31 29.79 ["]	10	9 56 41.697 ^s	17 41 55.51 ["]
11	8 07 56.907 ^s	25 24 55.43 ["]	11	9 58 54.835 ^s	17 29 12.64 ["]
12	8 10 20.753 ^s	25 18 12.04 ["]	12	10 01 07.742 ^s	17 16 23.76 ["]
13	8 12 44.422 ^s	25 11 19.66 ["]	13	10 03 20.422 ^s	17 03 28.94 ["]
14	8 15 07.912 ^s	25 04 18.33 ["]	14	10 05 32.875 ^s	16 50 28.27 ["]
15	8 17 31.217 ^s	24 57 08.11 ["]	15	10 07 45.104 ^s	16 37 21.82 ["]
16	8 19 54.334 ^s	24 49 49.03 ["]	16	10 09 57.112 ^s	16 24 09.65 ["]
17	8 22 17.258 ^s	24 42 21.15 ["]	17	10 12 08.901 ^s	16 10 51.86 ["]
18	8 24 39.985 ^s	24 34 44.52 ["]	18	10 14 20.473 ^s	15 57 28.51 ["]
19	8 27 02.513 ^s	24 26 59.18 ["]	19	10 16 31.830 ^s	15 43 59.68 ["]
20	8 29 24.836 ^s	24 19 05.19 ["]	20	10 18 42.976 ^s	15 30 25.45 ["]
21	8 31 46.953 ^s	24 11 02.61 ["]	21	10 20 53.914 ^s	15 16 45.89 ["]
22	8 34 08.859 ^s	24 02 51.47 ["]	22	10 23 04.645 ^s	15 03 01.09 ["]
23	8 36 30.552 ^s	23 54 31.84 ["]	23	10 25 15.173 ^s	14 49 11.10 ["]
24	8 38 52.028 ^s	+23 46 03.78 ["]	24	10 27 25.501 ^s	+14 35 16.03 ["]
	141.476	-508.06		130.328	-835.07

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 14			June 16		
h	h m s	° ' "	h	h m s	° ' "
0	10 27 25.501 130.130	+14 35 16.03 -840.10	0	12 09 01.784 125.536	+ 2 12 55.35 -988.10
1	10 29 35.631 129.937	14 21 15.93 845.04	1	12 11 07.320 125.560	1 56 27.25 989.18
2	10 31 45.568 129.747	14 07 10.89 849.91	2	12 13 12.880 125.589	1 39 58.07 990.19
3	10 33 55.315 129.559	13 53 00.98 854.69	3	12 15 18.469 125.623	1 23 27.88 991.10
4	10 36 04.874 129.375	13 38 46.29 859.40	4	12 17 24.092 125.663	1 06 56.78 991.93
5	10 38 14.249 129.195	13 24 26.89 864.04	5	12 19 29.755 125.708	0 50 24.85 992.68
6	10 40 23.444 129.018	13 10 02.85 868.58	6	12 21 35.463 125.759	0 33 52.17 993.34
7	10 42 32.462 128.844	12 55 34.27 873.07	7	12 23 41.222 125.814	0 17 18.83 993.90
8	10 44 41.306 128.676	12 41 01.20 877.47	8	12 25 47.036 125.875	+ 0 00 44.93 994.39
9	10 46 49.982 128.509	12 26 23.73 881.78	9	12 27 52.911 125.942	- 0 15 49.46 994.79
10	10 48 58.491 128.347	12 11 41.95 886.03	10	12 29 58.853 126.014	0 32 24.25 995.10
11	10 51 06.838 128.190	11 56 55.92 890.19	11	12 32 04.867 126.091	0 48 59.35 995.32
12	10 53 15.028 128.035	11 42 05.73 894.28	12	12 34 10.958 126.174	1 05 34.67 995.45
13	10 55 23.063 127.885	11 27 11.45 898.29	13	12 36 17.132 126.262	1 22 10.12 995.50
14	10 57 30.948 127.739	11 12 13.16 902.21	14	12 38 23.394 126.356	1 38 45.62 995.45
15	10 59 38.687 127.598	10 57 10.95 906.07	15	12 40 29.750 126.454	1 55 21.07 995.32
16	11 01 46.285 127.460	10 42 04.88 909.84	16	12 42 36.204 126.559	2 11 56.39 995.09
17	11 03 53.745 127.326	10 26 55.04 913.53	17	12 44 42.763 126.668	2 28 31.48 994.78
18	11 06 01.071 127.197	10 11 41.51 917.14	18	12 46 49.431 126.784	2 45 06.26 994.38
19	11 08 08.268 127.073	9 56 24.37 920.68	19	12 48 56.215 126.904	3 01 40.64 993.88
20	11 10 15.341 126.952	9 41 03.69 924.13	20	12 51 03.119 127.030	3 18 14.52 993.29
21	11 12 22.293 126.836	9 25 39.56 927.51	21	12 53 10.149 127.161	3 34 47.81 992.62
22	11 14 29.129 126.725	9 10 12.05 930.80	22	12 55 17.310 127.298	3 51 20.43 991.84
23	11 16 35.854 126.618	+ 8 54 41.25 -934.02	23	12 57 24.608 127.439	- 4 07 52.27 -990.98
June 15			June 17		
h	h m s	° ' "	h	h m s	° ' "
0	11 18 42.472 126.516	+ 8 39 07.23 -937.16	0	12 59 32.047 127.587	- 4 24 23.25 -990.02
1	11 20 48.988 126.418	8 23 30.07 940.22	1	13 01 39.634 127.739	4 40 53.27 988.98
2	11 22 55.406 126.326	8 07 49.85 943.19	2	13 03 47.373 127.897	4 57 22.25 987.82
3	11 25 01.732 126.237	7 52 06.66 946.09	3	13 05 55.270 128.060	5 13 50.07 986.59
4	11 27 07.969 126.154	7 36 20.57 948.91	4	13 08 03.330 128.228	5 30 16.66 985.26
5	11 29 14.123 126.075	7 20 31.66 951.64	5	13 10 11.558 128.401	5 46 41.92 983.83
6	11 31 20.198 126.002	7 04 40.02 954.30	6	13 12 19.959 128.580	6 03 05.75 982.30
7	11 33 26.200 125.932	6 48 45.72 956.87	7	13 14 28.539 128.764	6 19 28.05 980.68
8	11 35 32.132 125.869	6 32 48.85 959.36	8	13 16 37.303 128.953	6 35 48.73 978.97
9	11 37 38.001 125.809	6 16 49.49 961.78	9	13 18 46.256 129.146	6 52 07.70 977.15
10	11 39 43.810 125.756	6 00 47.71 964.11	10	13 20 55.402 129.346	7 08 24.85 975.24
11	11 41 49.566 125.706	5 44 43.60 966.36	11	13 23 04.748 129.550	7 24 40.09 973.23
12	11 43 55.272 125.663	5 28 37.24 968.53	12	13 25 14.298 129.759	7 40 53.32 971.13
13	11 46 00.935 125.623	5 12 28.71 970.62	13	13 27 24.057 129.973	7 57 04.45 968.91
14	11 48 06.558 125.590	4 56 18.09 972.62	14	13 29 34.030 130.191	8 13 13.36 966.61
15	11 50 12.148 125.561	4 40 05.47 974.54	15	13 31 44.221 130.416	8 29 19.97 964.21
16	11 52 17.709 125.537	4 23 50.93 976.38	16	13 33 54.637 130.644	8 45 24.18 961.70
17	11 54 23.246 125.519	4 07 34.55 978.14	17	13 36 05.281 130.878	9 01 25.88 959.09
18	11 56 28.765 125.506	3 51 16.41 979.81	18	13 38 16.159 131.116	9 17 24.97 956.39
19	11 58 34.271 125.497	3 34 56.60 981.40	19	13 40 27.275 131.359	9 33 21.36 953.58
20	12 00 39.768 125.495	3 18 35.20 982.91	20	13 42 38.634 131.607	9 49 14.94 950.66
21	12 02 45.263 125.497	3 02 12.29 984.33	21	13 44 50.241 131.858	10 05 05.60 947.65
22	12 04 50.760 125.505	2 45 47.96 985.68	22	13 47 02.099 132.115	10 20 53.25 944.54
23	12 06 56.265 125.519	2 29 22.28 -986.93	23	13 49 14.214 132.377	10 36 37.79 -941.32
24	12 09 01.784	+ 2 12 55.35	24	13 51 26.591	-10 52 19.11

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 18			June 20		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	13 51 26.591	132.641	0	15 43 32.392	148.575
1	13 53 39.232	132.912	1	15 46 00.967	148.916
2	13 55 52.144	133.185	2	15 48 29.883	149.255
3	13 58 05.329	133.464	3	15 50 59.138	149.590
4	14 00 18.793	133.746	4	15 53 28.728	149.922
5	14 02 32.539	134.032	5	15 55 58.650	150.252
6	14 04 46.571	134.323	6	15 58 28.902	150.578
7	14 07 00.894	134.617	7	16 00 59.480	150.899
8	14 09 15.511	134.915	8	16 03 30.379	151.218
9	14 11 30.426	135.217	9	16 06 01.597	151.531
10	14 13 45.643	135.522	10	16 08 33.128	151.841
11	14 16 01.165	135.831	11	16 11 04.969	152.147
12	14 18 16.996	136.143	12	16 13 37.116	152.447
13	14 20 33.139	136.458	13	16 16 09.563	152.742
14	14 22 49.597	136.778	14	16 18 42.305	153.032
15	14 25 06.375	137.099	15	16 21 15.337	153.317
16	14 27 23.474	137.424	16	16 23 48.654	153.596
17	14 29 40.898	137.752	17	16 26 22.250	153.870
18	14 31 58.650	138.082	18	16 28 56.120	154.137
19	14 34 16.732	138.416	19	16 31 30.257	154.397
20	14 36 35.148	138.751	20	16 34 04.654	154.652
21	14 38 53.899	139.090	21	16 36 39.306	154.900
22	14 41 12.989	139.430	22	16 39 14.206	155.141
23	14 43 32.419	139.772	23	16 41 49.347	155.375
June 19			June 21		
0	14 45 52.191	140.117	0	16 44 24.722	155.602
1	14 48 12.308	140.463	1	16 47 00.324	155.820
2	14 50 32.771	140.811	2	16 49 36.144	156.033
3	14 52 53.582	141.161	3	16 52 12.177	156.236
4	14 55 14.743	141.513	4	16 54 48.413	156.431
5	14 57 36.256	141.864	5	16 57 24.844	156.620
6	14 59 58.120	142.218	6	17 00 01.464	156.798
7	15 02 20.338	142.573	7	17 02 38.262	156.969
8	15 04 42.911	142.927	8	17 05 15.231	157.131
9	15 07 05.838	143.284	9	17 07 52.362	157.284
10	15 09 29.122	143.640	10	17 10 29.646	157.428
11	15 11 52.762	143.997	11	17 13 07.074	157.563
12	15 14 16.759	144.353	12	17 15 44.637	157.690
13	15 16 41.112	144.710	13	17 18 22.327	157.805
14	15 19 05.822	145.067	14	17 21 00.132	157.912
15	15 21 30.889	145.422	15	17 23 38.044	158.010
16	15 23 56.311	145.778	16	17 26 16.054	158.097
17	15 26 22.089	146.132	17	17 28 54.151	158.174
18	15 28 48.221	146.486	18	17 31 32.325	158.242
19	15 31 14.707	146.839	19	17 34 10.567	158.299
20	15 33 41.546	147.189	20	17 36 48.866	158.347
21	15 36 08.735	147.539	21	17 39 27.213	158.384
22	15 38 36.274	147.886	22	17 42 05.597	158.411
23	15 41 04.160	148.232	23	17 44 44.008	158.428
24	15 43 32.392	148.575	24	17 47 22.436	158.428

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 22			June 24		
h	h m s	° ' "	h	h m s	° ' "
0	17 47 22.436 ^s 158.434	-27 24 49.29 ^s -157.64	0	19 51 09.265 ^s 147.414	-26 04 58.38 ^s +348.24
1	17 50 00.870 ^s 158.429	27 27 26.93 ^s 146.30	1	19 53 36.679 ^s 147.000	25 59 10.14 ^s 357.18
2	17 52 39.299 ^s 158.415	27 29 53.23 ^s 134.94	2	19 56 03.679 ^s 146.583	25 53 12.96 ^s 366.01
3	17 55 17.714 ^s 158.389	27 32 08.17 ^s 123.60	3	19 58 30.262 ^s 146.161	25 47 06.95 ^s 374.76
4	17 57 56.103 ^s 158.354	27 34 11.77 ^s 112.26	4	20 00 56.423 ^s 145.736	25 40 52.19 ^s 383.42
5	18 00 34.457 ^s 158.308	27 36 04.03 ^s 100.91	5	20 03 22.159 ^s 145.306	25 34 28.77 ^s 391.99
6	18 03 12.765 ^s 158.250	27 37 44.94 ^s 89.59	6	20 05 47.465 ^s 144.873	25 27 56.78 ^s 400.47
7	18 05 51.015 ^s 158.184	27 39 14.53 ^s 78.27	7	20 08 12.338 ^s 144.436	25 21 16.31 ^s 408.86
8	18 08 29.199 ^s 158.105	27 40 32.80 ^s 66.96	8	20 10 36.774 ^s 143.997	25 14 27.45 ^s 417.14
9	18 11 07.304 ^s 158.017	27 41 39.76 ^s 55.67	9	20 13 00.771 ^s 143.554	25 07 30.31 ^s 425.34
10	18 13 45.321 ^s 157.919	27 42 35.43 ^s 44.41	10	20 15 24.325 ^s 143.110	25 00 24.97 ^s 433.45
11	18 16 23.240 ^s 157.809	27 43 19.84 ^s 33.15	11	20 17 47.435 ^s 142.661	24 53 11.52 ^s 441.46
12	18 19 01.049 ^s 157.689	27 43 52.99 ^s 21.92	12	20 20 10.096 ^s 142.211	24 45 50.06 ^s 449.38
13	18 21 38.738 ^s 157.560	27 44 14.91 ^s 10.72	13	20 22 32.307 ^s 141.758	24 38 20.68 ^s 457.20
14	18 24 16.298 ^s 157.419	27 44 25.63 ^s 0.45	14	20 24 54.065 ^s 141.304	24 30 43.48 ^s 464.93
15	18 26 53.717 ^s 157.269	27 44 25.18 ^s 11.60	15	20 27 15.369 ^s 140.848	24 22 58.55 ^s 472.56
16	18 29 30.986 ^s 157.108	27 44 13.58 ^s 22.70	16	20 29 36.217 ^s 140.391	24 15 05.99 ^s 480.09
17	18 32 08.094 ^s 156.938	27 43 50.88 ^s 33.77	17	20 31 56.608 ^s 139.931	24 07 05.90 ^s 487.55
18	18 34 45.032 ^s 156.757	27 43 17.11 ^s 44.81	18	20 34 16.539 ^s 139.470	23 58 58.35 ^s 494.89
19	18 37 21.789 ^s 156.567	27 42 32.30 ^s 55.80	19	20 36 36.009 ^s 139.010	23 50 43.46 ^s 502.14
20	18 39 58.356 ^s 156.366	27 41 36.50 ^s 66.76	20	20 38 55.019 ^s 138.547	23 42 21.32 ^s 509.30
21	18 42 34.722 ^s 156.157	27 40 29.74 ^s 77.66	21	20 41 13.566 ^s 138.084	23 33 52.02 ^s 516.36
22	18 45 10.879 ^s 155.938	27 39 12.08 ^s 88.52	22	20 43 31.650 ^s 137.621	23 25 15.66 ^s 523.33
23	18 47 46.817 ^s 155.709	-27 37 43.56 ^s +99.33	23	20 45 49.271 ^s 137.157	-23 16 32.33 ^s +530.20
June 23			June 25		
0	18 50 22.526 ^s 155.471	-27 36 04.23 ^s +110.09	0	20 48 06.428 ^s 136.694	-23 07 42.13 ^s +536.99
1	18 52 57.997 ^s 155.224	27 34 14.14 ^s 120.80	1	20 50 23.122 ^s 136.229	22 58 45.14 ^s 543.66
2	18 55 33.221 ^s 154.968	27 32 13.34 ^s 131.44	2	20 52 39.351 ^s 135.766	22 49 41.48 ^s 550.26
3	18 58 08.189 ^s 154.703	27 30 01.90 ^s 142.05	3	20 54 55.117 ^s 135.303	22 40 31.22 ^s 556.75
4	19 00 42.892 ^s 154.430	27 27 39.85 ^s 152.57	4	20 57 10.420 ^s 134.839	22 31 14.47 ^s 563.15
5	19 03 17.322 ^s 154.148	27 25 07.28 ^s 163.05	5	20 59 25.259 ^s 134.378	22 21 51.32 ^s 569.46
6	19 05 51.470 ^s 153.857	27 22 24.23 ^s 173.45	6	21 01 39.637 ^s 133.916	22 12 21.86 ^s 575.68
7	19 08 25.327 ^s 153.559	27 19 30.78 ^s 183.80	7	21 03 53.553 ^s 133.456	22 02 46.18 ^s 581.79
8	19 10 58.886 ^s 153.253	27 16 26.98 ^s 194.08	8	21 06 07.009 ^s 132.996	21 53 04.39 ^s 587.83
9	19 13 32.139 ^s 152.938	27 13 12.90 ^s 204.29	9	21 08 20.005 ^s 132.538	21 43 16.56 ^s 593.77
10	19 16 05.077 ^s 152.616	27 09 48.61 ^s 214.43	10	21 10 32.543 ^s 132.082	21 33 22.79 ^s 599.62
11	19 18 37.693 ^s 152.286	27 06 14.18 ^s 224.50	11	21 12 44.625 ^s 131.626	21 23 23.17 ^s 605.37
12	19 21 09.979 ^s 151.950	27 02 29.68 ^s 234.49	12	21 14 56.251 ^s 131.173	21 13 17.80 ^s 611.04
13	19 23 41.929 ^s 151.605	26 58 35.19 ^s 244.41	13	21 17 07.424 ^s 130.720	21 03 06.76 ^s 616.62
14	19 26 13.534 ^s 151.255	26 54 30.78 ^s 254.26	14	21 19 18.144 ^s 130.271	20 52 50.14 ^s 622.10
15	19 28 44.789 ^s 150.898	26 50 16.52 ^s 264.02	15	21 21 28.415 ^s 129.823	20 42 28.04 ^s 627.50
16	19 31 15.687 ^s 150.534	26 45 52.50 ^s 273.72	16	21 23 38.238 ^s 129.377	20 32 00.54 ^s 632.81
17	19 33 46.221 ^s 150.163	26 41 18.78 ^s 283.32	17	21 25 47.615 ^s 128.933	20 21 27.73 ^s 638.03
18	19 36 16.384 ^s 149.787	26 36 35.46 ^s 292.85	18	21 27 56.548 ^s 128.492	20 10 49.70 ^s 643.17
19	19 38 46.171 ^s 149.406	26 31 42.61 ^s 302.29	19	21 30 05.040 ^s 128.053	20 00 06.53 ^s 648.21
20	19 41 15.577 ^s 149.017	26 26 40.32 ^s 311.66	20	21 32 13.093 ^s 127.617	19 49 18.32 ^s 653.18
21	19 43 44.594 ^s 148.624	26 21 28.66 ^s 320.93	21	21 34 20.710 ^s 127.183	19 38 25.14 ^s 658.06
22	19 46 13.218 ^s 148.225	26 16 07.73 ^s 330.12	22	21 36 27.893 ^s 126.753	19 27 27.08 ^s 662.85
23	19 48 41.443 ^s 147.822	26 10 37.61 ^s +339.23	23	21 38 34.646 ^s 126.324	19 16 24.23 ^s +667.55
24	19 51 09.265 ^s	-26 04 58.38 ^s	24	21 40 40.970 ^s	-19 05 16.68 ^s

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 26			June 28		
h	h m s	° ' "	h	h m s	° ' "
0	21 40 40.970	-19 05 16.68	0	23 14 33.901	-9 03 25.53
1	21 42 46.869	125.899	1	23 16 24.032	8 49 55.41
2	21 44 52.346	125.477	2	23 18 13.946	8 36 23.89
3	21 46 57.404	125.058	3	23 20 03.647	8 22 51.02
4	21 49 02.047	124.643	4	23 21 53.141	8 09 16.85
5	21 51 06.276	124.229	5	23 23 42.431	7 55 41.44
6	21 53 10.097	123.821	6	23 25 31.523	7 42 04.81
7	21 55 13.512	123.415	7	23 27 20.421	7 28 27.04
8	21 57 16.525	123.013	8	23 29 09.131	7 14 48.16
9	21 59 19.139	122.614	9	23 30 57.657	7 01 08.22
10	22 01 21.359	122.220	10	23 32 46.004	6 47 27.27
11	22 03 23.187	121.828	11	23 34 34.177	6 33 45.35
12	22 05 24.627	121.440	12	23 36 22.181	6 20 02.51
13	22 07 25.684	121.057	13	23 38 10.020	6 06 18.80
14	22 09 26.361	120.677	14	23 39 57.700	5 52 34.26
15	22 11 26.663	120.302	15	23 41 45.225	5 38 48.94
16	22 13 26.592	119.929	16	23 43 32.599	5 25 02.87
17	22 15 26.154	119.562	17	23 45 19.829	5 11 16.11
18	22 17 25.352	119.198	18	23 47 06.918	4 57 28.70
19	22 19 24.190	118.838	19	23 48 53.871	4 43 40.67
20	22 21 22.673	118.483	20	23 50 40.694	4 29 52.09
21	22 23 20.805	118.132	21	23 52 27.391	4 16 02.98
22	22 25 18.590	117.785	22	23 54 13.966	4 02 13.38
23	22 27 16.032	117.442	23	23 56 00.426	3 48 23.35
	117.103	-14 30 45.89		106.348	+830.03
		+757.21			+830.42
June 27			June 29		
h	h m s	° ' "	h	h m s	° ' "
0	22 29 13.135	-14 18 08.68	0	23 57 46.774	-3 34 32.93
1	22 31 09.905	116.770	1	23 59 33.015	3 20 42.15
2	22 33 06.346	116.441	2	0 01 19.154	3 06 51.05
3	22 35 02.461	116.115	3	0 03 05.196	2 52 59.68
4	22 36 58.256	115.795	4	0 04 51.146	2 39 08.08
5	22 38 53.734	115.478	5	0 06 37.008	2 25 16.29
6	22 40 48.901	115.167	6	0 08 22.787	2 11 24.35
7	22 42 43.761	114.860	7	0 10 08.488	1 57 32.29
8	22 44 38.318	114.557	8	0 11 54.116	1 43 40.17
9	22 46 32.578	114.260	9	0 13 39.675	1 29 48.01
10	22 48 26.544	113.966	10	0 15 25.171	1 15 55.86
11	22 50 20.222	113.678	11	0 17 10.608	1 02 03.76
12	22 52 13.615	113.393	12	0 18 55.990	0 48 11.75
13	22 54 06.730	113.115	13	0 20 41.323	0 34 19.86
14	22 55 59.569	112.839	14	0 22 26.611	0 20 28.13
15	22 57 52.139	112.570	15	0 24 11.859	0 06 36.61
16	22 59 44.444	112.305	16	0 25 57.072	0 07 14.67
17	23 01 36.488	112.044	17	0 27 42.254	0 21 05.67
18	23 03 28.276	111.788	18	0 29 27.410	0 34 56.35
19	23 05 19.813	111.537	19	0 31 12.545	0 48 46.67
20	23 07 11.104	111.291	20	0 32 57.664	1 02 36.59
21	23 09 02.153	111.049	21	0 34 42.770	1 16 26.08
22	23 10 52.966	110.813	22	0 36 27.870	1 30 15.10
23	23 12 43.547	110.581	23	0 38 12.967	1 44 03.61
24	23 14 33.901	110.354	24	0 39 58.067	1 57 51.57
		-9 03 25.53			+827.96

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
June 30			July 2		
h	h m s	° ' "	h	h m s	° ' "
0	0 39 58.067	105.106	0	2 05 35.394	110.780
1	0 41 43.173	105.118	1	2 07 26.174	111.005
2	0 43 28.291	105.135	2	2 09 17.179	111.234
3	0 45 13.426	105.155	3	2 11 08.413	111.467
4	0 46 58.581	105.181	4	2 12 59.880	111.703
5	0 48 43.762	105.211	5	2 14 51.583	111.945
6	0 50 28.973	105.246	6	2 16 43.528	112.190
7	0 52 14.219	105.285	7	2 18 35.718	112.439
8	0 53 59.504	105.330	8	2 20 28.157	112.692
9	0 55 44.834	105.378	9	2 22 20.849	112.948
10	0 57 30.212	105.431	10	2 24 13.797	113.209
11	0 59 15.643	105.490	11	2 26 07.006	113.474
12	1 01 01.133	105.551	12	2 28 00.480	113.741
13	1 02 46.684	105.619	13	2 29 54.221	114.014
14	1 04 32.303	105.691	14	2 31 48.235	114.289
15	1 06 17.994	105.767	15	2 33 42.524	114.569
16	1 08 03.761	105.847	16	2 35 37.093	114.852
17	1 09 49.608	105.933	17	2 37 31.945	115.138
18	1 11 35.541	106.023	18	2 39 27.083	115.428
19	1 13 21.564	106.117	19	2 41 22.511	115.722
20	1 15 07.681	106.216	20	2 43 18.233	116.019
21	1 16 53.897	106.320	21	2 45 14.252	116.319
22	1 18 40.217	106.428	22	2 47 10.571	116.623
23	1 20 26.645	106.540	23	2 49 07.194	116.930
July 1			July 3		
0	1 22 13.185	106.657	0	2 51 04.124	117.241
1	1 23 59.842	106.778	1	2 53 01.365	117.554
2	1 25 46.620	106.905	2	2 54 58.919	117.871
3	1 27 33.525	107.035	3	2 56 56.790	118.191
4	1 29 20.560	107.169	4	2 58 54.981	118.514
5	1 31 07.729	107.309	5	3 00 53.495	118.839
6	1 32 55.038	107.453	6	3 02 52.334	119.169
7	1 34 42.491	107.601	7	3 04 51.503	119.500
8	1 36 30.092	107.753	8	3 06 51.003	119.834
9	1 38 17.845	107.910	9	3 08 50.837	120.172
10	1 40 05.755	108.072	10	3 10 51.009	120.512
11	1 41 53.827	108.237	11	3 12 51.521	120.853
12	1 43 42.064	108.407	12	3 14 52.374	121.199
13	1 45 30.471	108.581	13	3 16 53.573	121.546
14	1 47 19.052	108.760	14	3 18 55.119	121.896
15	1 49 07.812	108.943	15	3 20 57.015	122.247
16	1 50 56.755	109.130	16	3 22 59.262	122.602
17	1 52 45.885	109.322	17	3 25 01.864	122.958
18	1 54 35.207	109.517	18	3 27 04.822	123.317
19	1 56 24.724	109.718	19	3 29 08.139	123.676
20	1 58 14.442	109.921	20	3 31 11.815	124.039
21	2 00 04.363	110.130	21	3 33 15.854	124.402
22	2 01 54.493	110.342	22	3 35 20.256	124.768
23	2 03 44.835	110.559	23	3 37 25.024	125.135
24	2 05 35.394	110.780	24	3 39 30.159	125.503

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
July 4									July 6								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	3	39	30.159	125.504	+21	33	19.25	+562.51	0	5	26	49.964	142.529	+26	59	16.89	+218.26
1	3	41	35.663	125.873	21	42	41.76	557.01	1	5	29	12.493	142.812	27	02	55.15	209.45
2	3	43	41.536	126.245	21	51	58.77	551.43	2	5	31	35.305	143.091	27	06	24.60	200.57
3	3	45	47.781	126.617	22	01	10.20	545.79	3	5	33	58.396	143.364	27	09	45.17	191.64
4	3	47	54.398	126.990	22	10	15.99	540.08	4	5	36	21.760	143.631	27	12	56.81	182.66
5	3	50	01.388	127.365	22	19	16.07	534.29	5	5	38	45.391	143.893	27	15	59.47	173.62
6	3	52	08.753	127.740	22	28	10.36	528.43	6	5	41	09.284	144.148	27	18	53.09	164.52
7	3	54	16.493	128.116	22	36	58.79	522.51	7	5	43	33.432	144.399	27	21	37.61	155.39
8	3	56	24.609	128.492	22	45	41.30	516.50	8	5	45	57.831	144.641	27	24	13.00	146.19
9	3	58	33.101	128.870	22	54	17.80	510.44	9	5	48	22.472	144.880	27	26	39.19	136.94
10	4	00	41.971	129.246	23	02	48.24	504.29	10	5	50	47.352	145.110	27	28	56.13	127.66
11	4	02	51.217	129.625	23	11	12.53	498.07	11	5	53	12.462	145.335	27	31	03.79	118.32
12	4	05	00.842	130.002	23	19	30.60	491.79	12	5	55	37.797	145.553	27	33	02.11	108.94
13	4	07	10.844	130.381	23	27	42.39	485.43	13	5	58	03.350	145.765	27	34	51.05	99.51
14	4	09	21.225	130.757	23	35	47.82	479.00	14	6	00	29.115	145.969	27	36	30.56	90.05
15	4	11	31.982	131.136	23	43	46.82	472.49	15	6	02	55.084	146.166	27	38	00.61	80.53
16	4	13	43.118	131.512	23	51	39.31	465.91	16	6	05	21.250	146.358	27	39	21.14	70.99
17	4	15	54.630	131.889	23	59	25.22	459.27	17	6	07	47.608	146.541	27	40	32.13	61.40
18	4	18	06.519	132.265	24	07	04.49	452.54	18	6	10	14.149	146.717	27	41	33.53	51.78
19	4	20	18.784	132.640	24	14	37.03	445.75	19	6	12	40.866	146.886	27	42	25.31	42.12
20	4	22	31.424	133.014	24	22	02.78	438.88	20	6	15	07.752	147.049	27	43	07.43	32.43
21	4	24	44.438	133.388	24	29	21.66	431.94	21	6	17	34.801	147.203	27	43	39.86	22.70
22	4	26	57.826	133.759	24	36	33.60	424.93	22	6	20	02.004	147.349	27	44	02.56	12.95
23	4	29	11.585	134.130	+24	43	38.53	+417.85	23	6	22	29.353	147.490	+27	44	15.51	+3.16
July 5									July 7								
0	4	31	25.715	134.499	+24	50	36.38	+410.69	0	6	24	56.843	147.621	+27	44	18.67	-6.64
1	4	33	40.214	134.867	24	57	27.07	396.16	1	6	27	24.464	147.745	27	44	12.03	16.48
2	4	35	55.081	135.232	25	04	10.53	388.79	2	6	29	52.209	147.862	27	43	55.55	26.34
3	4	38	10.313	135.597	25	10	46.69	381.35	3	6	32	20.071	147.971	27	43	29.21	36.22
4	4	40	25.910	135.958	25	17	15.48	373.84	4	6	34	48.042	148.071	27	42	52.99	46.13
5	4	42	41.868	136.317	25	23	36.83	366.25	5	6	37	16.113	148.165	27	42	06.86	56.04
6	4	44	58.185	136.675	25	29	50.67	358.60	6	6	39	44.278	148.250	27	41	10.82	65.98
7	4	47	14.860	137.030	25	35	56.92	350.87	7	6	42	12.528	148.328	27	40	04.84	75.93
8	4	49	31.890	137.381	25	41	55.52	343.09	8	6	44	40.856	148.397	27	38	48.91	85.90
9	4	51	49.271	137.731	25	47	46.39	335.22	9	6	47	09.253	148.458	27	37	23.01	95.87
10	4	54	07.002	138.077	25	53	29.48	327.29	10	6	49	37.711	148.513	27	35	47.14	105.87
11	4	56	25.079	138.420	25	59	04.70	319.30	11	6	52	06.224	148.558	27	34	01.27	115.85
12	4	58	43.499	138.760	26	04	31.99	311.23	12	6	54	34.782	148.596	27	32	05.42	125.86
13	5	01	02.259	139.097	26	09	51.29	303.09	13	6	57	03.378	148.626	27	29	59.56	135.86
14	5	03	21.356	139.429	26	15	02.52	294.90	14	6	59	32.004	148.648	27	27	43.70	145.87
15	5	05	40.785	139.759	26	20	05.61	286.64	15	7	02	00.652	148.662	27	25	17.83	155.88
16	5	08	00.544	140.083	26	25	00.51	278.91	16	7	04	29.314	148.669	27	22	41.95	165.88
17	5	10	20.627	140.405	26	29	47.15	269.31	17	7	06	57.983	148.668	27	19	56.07	175.89
18	5	12	41.032	140.722	26	34	25.46	261.46	18	7	09	26.651	148.658	27	17	00.18	185.89
19	5	15	01.754	141.035	26	38	55.37	252.95	19	7	11	55.309	148.641	27	13	54.29	195.88
20	5	17	22.789	141.343	26	43	16.83	244.36	20	7	14	23.950	148.617	27	10	38.41	205.86
21	5	19	44.132	141.647	26	47	29.78	235.72	21	7	16	52.567	148.585	27	07	12.55	215.84
22	5	22	05.779	141.946	26	51	34.14	+227.03	22	7	19	21.152	148.545	27	03	36.71	225.80
23	5	24	27.725	142.239	26	55	29.86		23	7	21	49.697	148.497	26	59	50.91	-235.75
24	5	26	49.964		+26	59	16.89		24	7	24	18.194		+26	55	55.16	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination				
July 8							July 10								
^h 0	^h 7	^m 24	^s 18.194	[°] +26	['] 55	["] 55.16	^h 0	^h 9	^m 20	^s 09.418	[°] +20	['] 43	["] 49.88		
1	7	26	46.637	148.443	26	51	49.49	1	9	22	28.733	139.315	20	32	37.23
2	7	29	15.018	148.381	26	47	33.89	2	9	24	47.781	139.048	20	21	17.26
3	7	31	43.329	148.311	26	43	08.40	3	9	27	06.561	138.780	20	09	50.03
4	7	34	11.564	148.235	26	38	33.04	4	9	29	25.073	138.512	19	58	15.62
5	7	36	39.715	148.151	26	33	47.83	5	9	31	43.318	138.245	19	46	34.13
6	7	39	07.775	148.060	26	28	52.79	6	9	34	01.294	137.976	19	34	45.62
7	7	41	35.738	147.963	26	23	47.95	7	9	36	19.001	137.707	19	22	50.19
8	7	44	03.596	147.858	26	18	33.34	8	9	38	36.441	137.440	19	10	47.91
9	7	46	31.343	147.747	26	13	08.99	9	9	40	53.613	137.172	18	58	38.86
10	7	48	58.972	147.629	26	07	34.93	10	9	43	10.517	136.904	18	46	23.13
11	7	51	26.476	147.504	26	01	51.19	11	9	45	27.154	136.637	18	34	00.80
12	7	53	53.850	147.374	25	55	57.81	12	9	47	43.526	136.372	18	21	31.96
13	7	56	21.086	147.236	25	49	54.83	13	9	49	59.632	136.106	18	08	56.69
14	7	58	48.179	147.093	25	43	42.27	14	9	52	15.473	135.841	17	56	15.08
15	8	01	15.123	146.944	25	37	20.19	15	9	54	31.051	135.578	17	43	27.20
16	8	03	41.911	146.788	25	30	48.62	16	9	56	46.368	135.317	17	30	33.15
17	8	06	08.539	146.628	25	24	07.61	17	9	59	01.423	135.055	17	17	33.00
18	8	08	35.000	146.461	25	17	17.20	18	10	01	16.219	134.796	17	04	26.86
19	8	11	01.289	146.289	25	10	17.44	19	10	03	30.758	134.539	16	51	14.79
20	8	13	27.400	146.111	25	03	08.37	20	10	05	45.040	134.282	16	37	56.89
21	8	15	53.329	145.929	24	55	50.05	21	10	07	59.069	134.029	16	24	33.25
22	8	18	19.069	145.740	24	48	22.52	22	10	10	12.845	133.776	16	11	03.95
23	8	20	44.617	145.548	24	40	45.83	23	10	12	26.370	133.525	+15	57	29.07
			145.351				-465.79				133.278				-820.36
July 9							July 11								
0	8	23	09.968	145.148	+24	33	00.04	0	10	14	39.648	133.032	+15	43	48.71
1	8	25	35.116	144.942	24	25	05.20	1	10	16	52.680	132.788	15	30	02.96
2	8	28	00.058	144.731	24	17	01.37	2	10	19	05.468	132.547	15	16	11.89
3	8	30	24.789	144.516	24	08	48.61	3	10	21	18.015	132.309	15	02	15.60
4	8	32	49.305	144.296	24	00	26.97	4	10	23	30.324	132.072	14	48	14.17
5	8	35	13.601	144.074	23	51	56.51	5	10	25	42.396	131.840	14	34	07.70
6	8	37	37.675	143.847	23	43	17.30	6	10	27	54.236	131.609	14	19	56.26
7	8	40	01.522	143.616	23	34	29.39	7	10	30	05.845	131.382	14	05	39.95
8	8	42	25.138	143.383	23	25	32.86	8	10	32	17.227	131.158	13	51	18.86
9	8	44	48.521	143.146	23	16	27.75	9	10	34	28.385	130.936	13	36	53.07
10	8	47	11.667	142.907	23	07	14.14	10	10	36	39.321	130.719	13	22	22.67
11	8	49	34.574	142.663	22	57	52.10	11	10	38	50.040	130.503	13	07	47.74
12	8	51	57.237	142.418	22	48	21.69	12	10	41	00.543	130.293	12	53	08.39
13	8	54	19.655	142.170	22	38	42.98	13	10	43	10.836	130.084	12	38	24.69
14	8	56	41.825	141.919	22	28	56.04	14	10	45	20.920	129.880	12	23	36.73
15	8	59	03.744	141.666	22	19	00.94	15	10	47	30.800	129.678	12	08	44.60
16	9	01	25.410	141.411	22	08	57.75	16	10	49	40.478	129.482	11	53	48.39
17	9	03	46.821	141.155	21	58	46.55	17	10	51	49.960	129.288	11	38	48.19
18	9	06	07.976	140.896	21	48	27.40	18	10	53	59.248	129.099	11	23	44.08
19	9	08	28.872	140.635	21	38	00.38	19	10	56	08.347	128.912	11	08	36.15
20	9	10	49.507	140.374	21	27	25.57	20	10	58	17.259	128.731	10	53	24.50
21	9	13	09.881	140.110	21	16	43.03	21	11	00	25.990	128.553	10	38	09.20
22	9	15	29.991	139.846	21	05	52.85	22	11	02	34.543	128.379	10	22	50.34
23	9	17	49.837	139.581	20	54	55.11	23	11	04	42.922	128.209	10	07	28.02
24	9	20	09.418		+20	43	49.88	24	11	06	51.131		+9	52	02.32

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
July 12							July 14						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	11	06	51.131	128.044	+	9 52 02.32	0	12	47	37.214	125.772	-	3 06 24.58
1	11	08	59.175	127.882		9 36 33.32	1	12	49	42.986	125.852		3 22 49.77
2	11	11	07.057	127.725		9 21 01.13	2	12	51	48.838	125.938		3 39 14.03
3	11	13	14.782	127.573		9 05 25.81	3	12	53	54.776	126.027		3 55 37.25
4	11	15	22.355	127.424		8 49 47.47	4	12	56	00.803	126.124		4 11 59.36
5	11	17	29.779	127.281		8 34 06.18	5	12	58	06.927	126.224		4 28 20.26
6	11	19	37.060	127.141		8 18 22.03	6	13	00	13.151	126.331		4 44 39.87
7	11	21	44.201	127.006		8 02 35.12	7	13	02	19.482	126.442		5 00 58.10
8	11	23	51.207	126.876		7 46 45.53	8	13	04	25.924	126.559		5 17 14.87
9	11	25	58.083	126.751		7 30 53.34	9	13	06	32.483	126.680		5 33 30.08
10	11	28	04.834	126.629		7 14 58.65	10	13	08	39.163	126.808		5 49 43.65
11	11	30	11.463	126.513		6 59 01.54	11	13	10	45.971	126.940		6 05 55.49
12	11	32	17.976	126.402		6 43 02.09	12	13	12	52.911	127.078		6 22 05.51
13	11	34	24.378	126.295		6 27 00.39	13	13	14	59.989	127.219		6 38 13.62
14	11	36	30.673	126.193		6 10 56.54	14	13	17	07.208	127.368		6 54 19.74
15	11	38	36.866	126.097		5 54 50.61	15	13	19	14.576	127.520		7 10 23.78
16	11	40	42.963	126.004		5 38 42.69	16	13	21	22.096	127.678		7 26 25.64
17	11	42	48.967	125.916		5 22 32.88	17	13	23	29.774	127.840		7 42 25.24
18	11	44	54.883	125.835		5 06 21.24	18	13	25	37.614	128.009		7 58 22.49
19	11	47	00.718	125.757		4 50 07.88	19	13	27	45.623	128.181		8 14 17.30
20	11	49	06.475	125.685		4 33 52.88	20	13	29	53.804	128.358		8 30 09.58
21	11	51	12.160	125.618		4 17 36.32	21	13	32	02.162	128.541		8 45 59.23
22	11	53	17.778	125.555		4 01 18.30	22	13	34	10.703	128.728		9 01 46.18
23	11	55	23.333	125.499	+	3 44 58.88	23	13	36	19.431	128.920	-	9 17 30.33
July 13							July 15						
0	11	57	28.832	125.446	+	3 28 38.18	0	13	38	28.351	129.117	-	9 33 11.58
1	11	59	34.278	125.400		3 12 16.25	1	13	40	37.468	129.319		9 48 49.86
2	12	01	39.678	125.358		2 55 53.21	2	13	42	46.787	129.525		10 04 25.06
3	12	03	45.036	125.322		2 39 29.12	3	13	44	56.312	129.735		10 19 57.10
4	12	05	50.358	125.290		2 23 04.08	4	13	47	06.047	129.951		10 35 25.88
5	12	07	55.648	125.264		2 06 38.18	5	13	49	15.998	130.171		10 50 51.32
6	12	10	00.912	125.243		1 50 11.49	6	13	51	26.169	130.395		11 06 13.32
7	12	12	06.155	125.228		1 33 44.10	7	13	53	36.564	130.624		11 21 31.79
8	12	14	11.383	125.217		1 17 16.11	8	13	55	47.188	130.858		11 36 46.64
9	12	16	16.600	125.212		1 00 47.59	9	13	57	58.046	131.094		11 51 57.77
10	12	18	21.812	125.213		0 44 18.63	10	14	00	09.140	131.336		12 07 05.10
11	12	20	27.025	125.217		0 27 49.32	11	14	02	20.476	131.582		12 22 08.53
12	12	22	32.242	125.229	+	0 11 19.75	12	14	04	32.058	131.832		12 37 07.96
13	12	24	37.471	125.245	-	0 05 10.01	13	14	06	43.890	132.086		12 52 03.32
14	12	26	42.716	125.265		0 21 39.86	14	14	08	55.976	132.344		13 06 54.49
15	12	28	47.981	125.293		0 38 09.72	15	14	11	08.320	132.605		13 21 41.39
16	12	30	53.274	125.325		0 54 39.50	16	14	13	20.925	132.871		13 36 23.93
17	12	32	58.599	125.362		1 11 09.11	17	14	15	33.796	133.140		13 51 02.00
18	12	35	03.961	125.404		1 27 38.48	18	14	17	46.936	133.413		14 05 35.53
19	12	37	09.365	125.453		1 44 07.51	19	14	20	00.349	133.689		14 20 04.40
20	12	39	14.818	125.506		2 00 36.11	20	14	22	14.038	133.970		14 34 28.54
21	12	41	20.324	125.564		2 17 04.21	21	14	24	28.008	134.252		14 48 47.84
22	12	43	25.888	125.629		2 33 31.71	22	14	26	42.260	134.540		15 03 02.21
23	12	45	31.517	125.697		2 49 58.53	23	14	28	56.800	134.829		15 17 11.55
24	12	47	37.214		-	3 06 24.58	24	14	31	11.629		-	15 31 15.78

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination						
July 16									July 18											
h	h	m	s	°	'	"	h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	14	31	11.629	135.121	-15	31 15.78	0	16	25	15.491	150.193	-24	35 39.16	0	16	25	15.491	150.193	-24	35 39.16
1	14	33	26.750	135.418	15	45 14.79	1	16	27	45.684	150.461	24	43 39.21	1	16	27	45.684	150.461	24	43 39.21
2	14	35	42.168	135.716	15	59 08.50	2	16	30	16.145	150.723	24	51 29.72	2	16	30	16.145	150.723	24	51 29.72
3	14	37	57.884	136.018	16	12 56.80	3	16	32	46.868	150.981	24	59 10.61	3	16	32	46.868	150.981	24	59 10.61
4	14	40	13.902	136.322	16	26 39.60	4	16	35	17.849	151.234	25	06 41.82	4	16	35	17.849	151.234	25	06 41.82
5	14	42	30.224	136.628	16	40 16.80	5	16	37	49.083	151.480	25	14 03.27	5	16	37	49.083	151.480	25	14 03.27
6	14	44	46.852	136.938	16	53 48.32	6	16	40	20.563	151.721	25	21 14.91	6	16	40	20.563	151.721	25	21 14.91
7	14	47	03.790	137.249	17	07 14.05	7	16	42	52.284	151.956	25	28 16.67	7	16	42	52.284	151.956	25	28 16.67
8	14	49	21.039	137.563	17	20 33.91	8	16	45	24.240	152.185	25	35 08.49	8	16	45	24.240	152.185	25	35 08.49
9	14	51	38.602	137.879	17	33 47.79	9	16	47	56.425	152.408	25	41 50.31	9	16	47	56.425	152.408	25	41 50.31
10	14	53	56.481	138.196	17	46 55.60	10	16	50	28.833	152.624	25	48 22.07	10	16	50	28.833	152.624	25	48 22.07
11	14	56	14.677	138.516	17	59 57.24	11	16	53	01.457	152.834	25	54 43.71	11	16	53	01.457	152.834	25	54 43.71
12	14	58	33.193	138.837	18	12 52.63	12	16	55	34.291	153.036	26	00 55.18	12	16	55	34.291	153.036	26	00 55.18
13	15	00	52.030	139.160	18	25 41.66	13	16	58	07.327	153.232	26	06 56.42	13	16	58	07.327	153.232	26	06 56.42
14	15	03	11.190	139.484	18	38 24.25	14	17	00	40.559	153.421	26	12 47.38	14	17	00	40.559	153.421	26	12 47.38
15	15	05	30.674	139.809	18	51 00.29	15	17	03	13.980	153.602	26	18 28.02	15	17	03	13.980	153.602	26	18 28.02
16	15	07	50.483	140.136	19	03 29.69	16	17	05	47.582	153.776	26	23 58.27	16	17	05	47.582	153.776	26	23 58.27
17	15	10	10.619	140.464	19	15 52.36	17	17	08	21.358	153.942	26	29 18.11	17	17	08	21.358	153.942	26	29 18.11
18	15	12	31.083	140.792	19	28 08.21	18	17	10	55.300	154.100	26	34 27.47	18	17	10	55.300	154.100	26	34 27.47
19	15	14	51.875	141.121	19	40 17.13	19	17	13	29.400	154.251	26	39 26.33	19	17	13	29.400	154.251	26	39 26.33
20	15	17	12.996	141.451	19	52 19.04	20	17	16	03.651	154.394	26	44 14.63	20	17	16	03.651	154.394	26	44 14.63
21	15	19	34.447	141.781	20	04 13.85	21	17	18	38.045	154.528	26	48 52.35	21	17	18	38.045	154.528	26	48 52.35
22	15	21	56.228	142.111	20	16 01.45	22	17	21	12.573	154.654	26	53 19.44	22	17	21	12.573	154.654	26	53 19.44
23	15	24	18.339	142.441	-20	27 41.76	23	17	23	47.227	154.771	-26	57 35.87	23	17	23	47.227	154.771	-26	57 35.87
July 17									July 19											
0	15	26	40.780	142.772	-20	39 14.69	0	17	26	21.998	154.880	-27	01 41.60	0	17	26	21.998	154.880	-27	01 41.60
1	15	29	03.552	143.101	20	50 40.14	1	17	28	56.878	154.981	27	05 36.62	1	17	28	56.878	154.981	27	05 36.62
2	15	31	26.653	143.430	21	01 58.02	2	17	31	31.859	155.073	27	09 20.88	2	17	31	31.859	155.073	27	09 20.88
3	15	33	50.083	143.760	21	13 08.25	3	17	34	06.932	155.155	27	12 54.36	3	17	34	06.932	155.155	27	12 54.36
4	15	36	13.843	144.087	21	24 10.72	4	17	36	42.087	155.228	27	16 17.04	4	17	36	42.087	155.228	27	16 17.04
5	15	38	37.930	144.415	21	35 05.36	5	17	39	17.315	155.294	27	19 28.90	5	17	39	17.315	155.294	27	19 28.90
6	15	41	02.345	144.740	21	45 52.06	6	17	41	52.609	155.348	27	22 29.91	6	17	41	52.609	155.348	27	22 29.91
7	15	43	27.085	145.065	21	56 30.75	7	17	44	27.957	155.396	27	25 20.07	7	17	44	27.957	155.396	27	25 20.07
8	15	45	52.150	145.387	22	07 01.33	8	17	47	03.353	155.432	27	27 59.35	8	17	47	03.353	155.432	27	27 59.35
9	15	48	17.537	145.709	22	17 23.72	9	17	49	38.785	155.459	27	30 27.74	9	17	49	38.785	155.459	27	30 27.74
10	15	50	43.246	146.028	22	27 37.83	10	17	52	14.244	155.478	27	32 45.23	10	17	52	14.244	155.478	27	32 45.23
11	15	53	09.274	146.346	22	37 43.57	11	17	54	49.722	155.487	27	34 51.82	11	17	54	49.722	155.487	27	34 51.82
12	15	55	35.620	146.660	22	47 40.86	12	17	57	25.209	155.486	27	36 47.49	12	17	57	25.209	155.486	27	36 47.49
13	15	58	02.280	146.973	22	57 29.61	13	18	00	00.695	155.476	27	38 32.25	13	18	00	00.695	155.476	27	38 32.25
14	16	00	29.253	147.283	23	07 09.74	14	18	02	36.171	155.456	27	40 06.09	14	18	02	36.171	155.456	27	40 06.09
15	16	02	56.536	147.590	23	16 41.17	15	18	05	11.627	155.426	27	41 29.01	15	18	05	11.627	155.426	27	41 29.01
16	16	05	24.126	147.894	23	26 03.81	16	18	07	47.053	155.388	27	42 41.02	16	18	07	47.053	155.388	27	42 41.02
17	16	07	52.020	148.194	23	35 17.59	17	18	10	22.441	155.339	27	43 42.12	17	18	10	22.441	155.339	27	43 42.12
18	16	10	20.214	148.492	23	44 22.42	18	18	12	57.780	155.281	27	44 32.32	18	18	12	57.780	155.281	27	44 32.32
19	16	12	48.706	148.786	23	53 18.22	19	18	15	33.061	155.213	27	45 11.63	19	18	15	33.061	155.213	27	45 11.63
20	16	15	17.492	149.075	24	02 04.92	20	18	18	08.274	155.135	27	45 40.06	20	18	18	08.274	155.135	27	45 40.06
21	16	17	46.567	149.361	24	10 42.44	21	18	20	43.409	155.049	27	45 57.62	21	18	20	43.409	155.049	27	45 57.62
22	16	20	15.928	149.643	24	19 10.70	22	18	23	18.458	154.953	27	46 04.34	22	18	23	18.458	154.953	27	46 04.34
23	16	22	45.571	149.920	24	27 20.63	23	18	25	53.411	154.846	27	46 00.22	23	18	25	53.411	154.846	27	46 00.22
24	16	25	15.491		-24	35 39.16	24	18	28	28.257		-27	45 45.30	24	18	28	28.257		-27	45 45.30

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension		Apparent Declination		Hour	Apparent Right Ascension		Apparent Declination	
July 20					July 22				
0	^h 18 ^m 28 ^s 257	^s 154.731	[°] 27 45 45.30	+ 25.70	0	^h 20 ^m 27 ^s 34.887	^s 140.316	[°] 24 17 02.00	+ 479.84
1	18 31 02.988	154.607	27 45 19.60	36.47	1	20 29 55.203	139.895	24 09 02.16	487.43
2	18 33 37.595	154.472	27 44 43.13	47.19	2	20 32 15.098	139.474	24 00 54.73	494.93
3	18 36 12.067	154.329	27 43 55.94	57.90	3	20 34 34.572	139.049	23 52 39.80	502.33
4	18 38 46.396	154.177	27 42 58.04	68.56	4	20 36 53.621	138.624	23 44 17.47	509.65
5	18 41 20.573	154.014	27 41 49.48	79.20	5	20 39 12.245	138.198	23 35 47.82	516.88
6	18 43 54.587	153.845	27 40 30.28	89.80	6	20 41 30.443	137.770	23 27 10.94	524.01
7	18 46 28.432	153.664	27 39 00.48	100.36	7	20 43 48.213	137.341	23 18 26.93	531.06
8	18 49 02.096	153.476	27 37 20.12	110.88	8	20 46 05.554	136.911	23 09 35.87	538.01
9	18 51 35.572	153.278	27 35 29.24	121.35	9	20 48 22.465	136.481	23 00 37.86	544.87
10	18 54 08.850	153.073	27 33 27.89	131.79	10	20 50 38.946	136.049	22 51 32.99	551.64
11	18 56 41.923	152.858	27 31 16.10	142.18	11	20 52 54.995	135.619	22 42 21.35	558.33
12	18 59 14.781	152.635	27 28 53.92	152.52	12	20 55 10.614	135.186	22 33 03.02	564.91
13	19 01 47.416	152.404	27 26 21.40	162.80	13	20 57 25.800	134.755	22 23 38.11	571.42
14	19 04 19.820	152.165	27 23 38.60	173.05	14	20 59 40.555	134.323	22 14 06.69	577.82
15	19 06 51.985	151.917	27 20 45.55	183.22	15	21 01 54.878	133.892	22 04 28.87	584.14
16	19 09 23.902	151.662	27 17 42.33	193.36	16	21 04 08.770	133.460	21 54 44.73	590.36
17	19 11 55.564	151.398	27 14 28.97	203.42	17	21 06 22.230	133.030	21 44 54.37	596.50
18	19 14 26.962	151.128	27 11 05.55	213.44	18	21 08 35.260	132.599	21 34 57.87	602.55
19	19 16 58.090	150.851	27 07 32.11	223.39	19	21 10 47.859	132.171	21 24 55.32	608.50
20	19 19 28.941	150.564	27 03 48.72	233.28	20	21 13 00.030	131.742	21 14 46.82	614.37
21	19 21 59.505	150.272	26 59 55.44	243.11	21	21 15 11.772	131.315	21 04 32.45	620.15
22	19 24 29.777	149.973	26 55 52.33	252.87	22	21 17 23.087	130.888	20 54 12.30	625.84
23	19 26 59.750	149.666	26 51 39.46	+ 262.56	23	21 19 33.975	130.464	20 43 46.46	+ 631.43
July 21					July 23				
0	19 29 29.416	149.353	26 47 16.90	+ 272.19	0	21 21 44.439	130.040	20 33 15.03	+ 636.94
1	19 31 58.769	149.034	26 42 44.71	281.74	1	21 23 54.479	129.618	20 22 38.09	642.37
2	19 34 27.803	148.708	26 38 02.97	291.23	2	21 26 04.097	129.198	20 11 55.72	647.70
3	19 36 56.511	148.376	26 33 11.74	300.65	3	21 28 13.295	128.780	20 01 08.02	652.95
4	19 39 24.887	148.038	26 28 11.09	309.99	4	21 30 22.075	128.362	19 50 15.07	658.11
5	19 41 52.925	147.694	26 23 01.10	319.25	5	21 32 30.437	127.948	19 39 16.96	663.19
6	19 44 20.619	147.345	26 17 41.85	328.44	6	21 34 38.385	127.535	19 28 13.77	668.17
7	19 46 47.964	146.991	26 12 13.41	337.55	7	21 36 45.920	127.125	19 17 05.60	673.08
8	19 49 14.955	146.631	26 06 35.86	346.59	8	21 38 53.045	126.716	19 05 52.52	677.90
9	19 51 41.586	146.266	26 00 49.27	355.55	9	21 40 59.761	126.311	18 54 34.62	682.63
10	19 54 07.852	145.896	25 54 53.72	364.42	10	21 43 06.072	125.907	18 43 11.99	687.28
11	19 56 33.748	145.522	25 48 49.30	373.22	11	21 45 11.979	125.506	18 31 44.71	691.84
12	19 58 59.270	145.143	25 42 36.08	381.93	12	21 47 17.485	125.108	18 20 12.87	696.33
13	20 01 24.413	144.760	25 36 14.15	390.56	13	21 49 22.593	124.713	18 08 36.54	700.73
14	20 03 49.173	144.372	25 29 43.59	399.11	14	21 51 27.306	124.320	17 56 55.81	705.05
15	20 06 13.545	143.982	25 23 04.48	407.57	15	21 53 31.626	123.930	17 45 10.76	709.29
16	20 08 37.527	143.586	25 16 16.91	415.95	16	21 55 35.556	123.543	17 33 21.47	713.44
17	20 11 01.113	143.188	25 09 20.96	424.25	17	21 57 39.099	123.159	17 21 28.03	717.52
18	20 13 24.301	142.786	25 02 16.71	432.44	18	21 59 42.258	122.779	17 09 30.51	721.52
19	20 15 47.087	142.382	24 55 04.27	440.57	19	22 01 45.037	122.401	16 57 28.99	725.44
20	20 18 09.469	141.973	24 47 43.70	448.60	20	22 03 47.438	122.027	16 45 23.55	729.28
21	20 20 31.442	141.563	24 40 15.10	456.54	21	22 05 49.465	121.657	16 33 14.27	733.04
22	20 22 53.005	141.149	24 32 38.56	464.40	22	22 07 51.122	121.288	16 21 01.23	736.73
23	20 25 14.154	140.733	24 24 54.16	+ 472.16	23	22 09 52.410	120.925	16 08 44.50	+ 740.34
24	20 27 34.887		24 17 02.00		24	22 11 53.335		15 56 24.16	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 24			July 26		
h	h m s	° ' "	h	h m s	° ' "
0	22 11 53.335 ^s 120.564	-15 56 24.16 ["] +743.87	0	23 42 47.550 ^s 108.099	-5 15 43.76 ["] +836.56
1	22 13 53.899 ^s 120.207	15 44 00.29 ["] 747.33	1	23 44 35.649 ^s 107.949	5 01 47.20 ["] 837.11
2	22 15 54.106 ^s 119.853	15 31 32.96 ["] 750.71	2	23 46 23.598 ^s 107.804	4 47 50.09 ["] 837.64
3	22 17 53.959 ^s 119.504	15 19 02.25 ["] 754.03	3	23 48 11.402 ^s 107.662	4 33 52.45 ["] 838.10
4	22 19 53.463 ^s 119.158	15 06 28.22 ["] 757.26	4	23 49 59.064 ^s 107.526	4 19 54.35 ["] 838.52
5	22 21 52.621 ^s 118.815	14 53 50.96 ["] 760.42	5	23 51 46.590 ^s 107.393	4 05 55.83 ["] 838.90
6	22 23 51.436 ^s 118.477	14 41 10.54 ["] 763.52	6	23 53 33.983 ^s 107.267	3 51 56.93 ["] 839.22
7	22 25 49.913 ^s 118.143	14 28 27.02 ["] 766.54	7	23 55 21.250 ^s 107.143	3 37 57.71 ["] 839.51
8	22 27 48.056 ^s 117.812	14 15 40.48 ["] 769.49	8	23 57 08.393 ^s 107.026	3 23 58.20 ["] 839.74
9	22 29 45.868 ^s 117.485	14 02 50.99 ["] 772.37	9	23 58 55.419 ^s 106.912	3 09 58.46 ["] 839.94
10	22 31 43.353 ^s 117.162	13 49 58.62 ["] 775.18	10	00 02 42.331 ^s 106.803	2 55 58.52 ["] 840.09
11	22 33 40.515 ^s 116.844	13 37 03.44 ["] 777.92	11	00 02 29.134 ^s 106.699	2 41 58.43 ["] 840.19
12	22 35 37.359 ^s 116.528	13 24 05.52 ["] 780.59	12	00 04 15.833 ^s 106.599	2 27 58.24 ["] 840.24
13	22 37 33.887 ^s 116.219	13 11 04.93 ["] 783.21	13	00 06 02.432 ^s 106.505	2 13 58.00 ["] 840.27
14	22 39 30.106 ^s 115.911	12 58 01.72 ["] 785.74	14	00 07 48.937 ^s 106.413	1 59 57.73 ["] 840.23
15	22 41 26.017 ^s 115.610	12 44 55.98 ["] 788.21	15	00 09 35.350 ^s 106.328	1 45 57.50 ["] 840.17
16	22 43 21.627 ^s 115.311	12 31 47.77 ["] 790.62	16	00 11 21.678 ^s 106.247	1 31 57.33 ["] 840.05
17	22 45 16.938 ^s 115.017	12 18 37.15 ["] 792.97	17	00 13 07.925 ^s 106.170	1 17 57.28 ["] 839.89
18	22 47 11.955 ^s 114.728	12 05 24.18 ["] 795.24	18	00 14 54.095 ^s 106.098	1 03 57.39 ["] 839.70
19	22 49 06.683 ^s 114.442	11 52 08.94 ["] 797.46	19	00 16 40.193 ^s 106.031	0 49 57.69 ["] 839.45
20	22 51 01.125 ^s 114.161	11 38 51.48 ["] 799.61	20	00 18 26.224 ^s 105.968	0 35 58.24 ["] 839.17
21	22 52 55.286 ^s 113.885	11 25 31.87 ["] 801.70	21	00 20 12.192 ^s 105.909	0 21 59.07 ["] 838.85
22	22 54 49.171 ^s 113.612	11 12 10.17 ["] 803.73	22	00 21 58.101 ^s 105.856	-0 08 00.22 ["] 838.48
23	22 56 42.783 ^s 113.343	-10 58 46.44 ["] +805.69	23	00 23 43.957 ^s 105.807	+0 05 58.26 ["] +838.07
July 25			July 27		
h	h m s	° ' "	h	h m s	° ' "
0	22 58 36.126 ^s 113.080	-10 45 20.75 ["] +807.60	0	00 25 29.764 ^s 105.762	+0 19 56.33 ["] +837.62
1	23 00 29.206 ^s 112.821	10 31 53.15 ["] 809.44	1	00 27 15.526 ^s 105.723	0 33 53.95 ["] 837.13
2	23 02 22.027 ^s 112.566	10 18 23.71 ["] 811.23	2	00 29 01.249 ^s 105.687	0 47 51.08 ["] 836.61
3	23 04 14.593 ^s 112.315	10 04 52.48 ["] 812.96	3	00 30 46.936 ^s 105.656	1 01 47.69 ["] 836.03
4	23 06 06.908 ^s 112.070	9 51 19.52 ["] 814.62	4	00 32 32.592 ^s 105.631	1 15 43.72 ["] 835.42
5	23 07 58.978 ^s 111.827	9 37 44.90 ["] 816.23	5	00 34 18.223 ^s 105.608	1 29 39.14 ["] 834.77
6	23 09 50.805 ^s 111.591	9 24 08.67 ["] 817.79	6	00 36 03.831 ^s 105.592	1 43 33.91 ["] 834.07
7	23 11 42.396 ^s 111.358	9 10 30.88 ["] 819.28	7	00 37 49.423 ^s 105.579	1 57 27.98 ["] 833.35
8	23 13 33.754 ^s 111.130	8 56 51.60 ["] 820.73	8	00 39 35.002 ^s 105.571	2 11 21.33 ["] 832.57
9	23 15 24.884 ^s 110.906	8 43 10.87 ["] 822.10	9	00 41 20.573 ^s 105.568	2 25 13.90 ["] 831.77
10	23 17 15.790 ^s 110.687	8 29 28.77 ["] 823.44	10	00 43 06.141 ^s 105.569	2 39 05.67 ["] 830.91
11	23 19 06.477 ^s 110.473	8 15 45.33 ["] 824.71	11	00 44 51.710 ^s 105.575	2 52 56.58 ["] 830.02
12	23 20 56.950 ^s 110.263	8 02 00.62 ["] 825.94	12	00 46 37.285 ^s 105.585	3 06 46.60 ["] 829.09
13	23 22 47.213 ^s 110.057	7 48 14.68 ["] 827.10	13	00 48 22.870 ^s 105.600	3 20 35.69 ["] 828.12
14	23 24 37.270 ^s 109.857	7 34 27.58 ["] 828.22	14	00 50 08.470 ^s 105.619	3 34 23.81 ["] 827.11
15	23 26 27.127 ^s 109.660	7 20 39.36 ["] 829.28	15	00 51 54.089 ^s 105.643	3 48 10.92 ["] 826.06
16	23 28 16.787 ^s 109.468	7 06 50.08 ["] 830.28	16	00 53 39.732 ^s 105.672	4 01 56.98 ["] 824.98
17	23 30 06.255 ^s 109.281	6 52 59.80 ["] 831.25	17	00 55 25.404 ^s 105.704	4 15 41.96 ["] 823.85
18	23 31 55.536 ^s 109.099	6 39 08.55 ["] 832.16	18	00 57 11.108 ^s 105.742	4 29 25.81 ["] 822.68
19	23 33 44.635 ^s 108.920	6 25 16.39 ["] 833.01	19	00 58 56.850 ^s 105.784	4 43 08.49 ["] 821.48
20	23 35 33.555 ^s 108.748	6 11 23.38 ["] 833.82	20	00 00 42.634 ^s 105.831	4 56 49.97 ["] 820.23
21	23 37 22.303 ^s 108.578	5 57 29.56 ["] 834.57	21	00 02 28.465 ^s 105.881	5 10 30.20 ["] 818.95
22	23 39 10.881 ^s 108.414	5 43 34.99 ["] 835.29	22	00 04 14.346 ^s 105.937	5 24 09.15 ["] 817.62
23	23 40 59.295 ^s 108.255	5 29 39.70 ["] +835.94	23	00 06 00.283 ^s 105.997	5 37 46.77 ["] +816.26
24	23 42 47.550 ^s	-5 15 43.76 ["]	24	00 07 46.280 ^s	+5 51 23.03 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
July 28			July 30		
h	h m s	° ' " +	h	h m s	° ' " +
0	1 07 46.280	106.061	0	2 35 10.665	114.249
1	1 09 32.341	106.130	1	2 37 04.914	114.520
2	1 11 18.471	106.203	2	2 38 59.434	114.794
3	1 13 04.674	106.282	3	2 40 54.228	115.072
4	1 14 50.956	106.363	4	2 42 49.300	115.354
5	1 16 37.319	106.451	5	2 44 44.654	115.639
6	1 18 23.770	106.542	6	2 46 40.293	115.927
7	1 20 10.312	106.637	7	2 48 36.220	116.219
8	1 21 56.949	106.737	8	2 50 32.439	116.514
9	1 23 43.686	106.842	9	2 52 28.953	116.814
10	1 25 30.528	106.951	10	2 54 25.767	117.116
11	1 27 17.479	107.064	11	2 56 22.883	117.421
12	1 29 04.543	107.183	12	2 58 20.304	117.730
13	1 30 51.726	107.304	13	3 00 18.034	118.042
14	1 32 39.030	107.430	14	3 02 16.076	118.357
15	1 34 26.460	107.562	15	3 04 14.433	118.675
16	1 36 14.022	107.697	16	3 06 13.108	118.996
17	1 38 01.719	107.837	17	3 08 12.104	119.321
18	1 39 49.556	107.980	18	3 10 11.425	119.648
19	1 41 37.536	108.129	19	3 12 11.073	119.977
20	1 43 25.665	108.282	20	3 14 11.050	120.311
21	1 45 13.947	108.438	21	3 16 11.361	120.646
22	1 47 02.385	108.600	22	3 18 12.007	120.984
23	1 48 50.985	108.765	23	3 20 12.991	121.325
		+10 56 29.25			+20 15 18.91
		+771.51			+602.21
July 29			July 31		
h	h m s	° ' " +	h	h m s	° ' " +
0	1 50 39.750	108.936	0	3 22 14.316	121.668
1	1 52 28.686	109.109	1	3 24 15.984	122.013
2	1 54 17.795	109.288	2	3 26 17.997	122.362
3	1 56 07.083	109.470	3	3 28 20.359	122.712
4	1 57 56.553	109.657	4	3 30 23.071	123.065
5	1 59 46.210	109.848	5	3 32 26.136	123.420
6	2 01 36.058	110.043	6	3 34 29.556	123.776
7	2 03 26.101	110.243	7	3 36 33.332	124.135
8	2 05 16.344	110.446	8	3 38 37.467	124.496
9	2 07 06.790	110.654	9	3 40 41.963	124.858
10	2 08 57.444	110.866	10	3 42 46.821	125.222
11	2 10 48.310	111.081	11	3 44 52.043	125.588
12	2 12 39.391	111.302	12	3 46 57.631	125.955
13	2 14 30.693	111.525	13	3 49 03.586	126.324
14	2 16 22.218	111.753	14	3 51 09.910	126.694
15	2 18 13.971	111.986	15	3 53 16.604	127.065
16	2 20 05.957	112.221	16	3 55 23.669	127.438
17	2 21 58.178	112.462	17	3 57 31.107	127.811
18	2 23 50.640	112.705	18	3 59 38.918	128.185
19	2 25 43.345	112.953	19	4 01 47.103	128.560
20	2 27 36.298	113.205	20	4 03 55.663	128.935
21	2 29 29.503	113.460	21	4 06 04.598	129.312
22	2 31 22.963	113.719	22	4 08 13.910	129.689
23	2 33 16.682	113.983	23	4 10 23.599	130.066
24	2 35 10.665		24	4 12 33.665	
		+16 04 18.55			+23 59 22.73
		+701.72			+467.18

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
August 1									August 3								
h	h	m	s	s	°	'	"	"	h	h	m	s	s	°	'	"	"
0	4	12	33.665	130.443	+23	59	22.73	+460.71	0	6	03	33.302	146.118	+27	45	09.29	+70.90
1	4	14	44.108	130.820		24	07 03.44	454.17	1	6	05	59.420	146.336		27	46 20.19	61.34
2	4	16	54.928	131.198		24	14 37.61	447.56	2	6	08	25.756	146.548		27	47 21.53	51.74
3	4	19	06.126	131.575		24	22 05.17	440.87	3	6	10	52.304	146.752		27	48 13.27	42.00
4	4	21	17.701	131.952		24	29 26.04	434.13	4	6	13	19.056	146.950		27	48 55.36	32.44
5	4	23	29.653	132.328		24	36 40.17	427.30	5	6	15	46.006	147.142		27	49 27.77	22.68
6	4	25	41.981	132.704		24	43 47.47	420.41	6	6	18	13.148	147.325		27	49 50.45	12.92
7	4	27	54.685	133.079		24	50 47.88	413.45	7	6	20	40.473	147.503		27	50 03.37	+3.11
8	4	30	07.764	133.454		24	57 41.33	406.41	8	6	23	07.976	147.672		27	50 06.48	-6.71
9	4	32	21.218	133.827		25	04 27.74	399.31	9	6	25	35.648	147.835		27	49 59.77	16.59
10	4	34	35.045	134.200		25	11 07.05	392.14	10	6	28	03.483	147.991		27	49 43.18	26.48
11	4	36	49.245	134.570		25	17 39.19	384.89	11	6	30	31.474	148.139		27	49 16.70	36.42
12	4	39	03.815	134.941		25	24 04.08	377.58	12	6	32	59.613	148.279		27	48 40.28	46.37
13	4	41	18.756	135.309		25	30 21.66	370.20	13	6	35	27.892	148.412		27	47 53.91	56.35
14	4	43	34.065	135.675		25	36 31.86	362.74	14	6	37	56.304	148.539		27	46 57.56	66.37
15	4	45	49.740	136.041		25	42 34.60	355.22	15	6	40	24.843	148.656		27	45 51.19	76.40
16	4	48	05.781	136.403		25	48 29.82	347.63	16	6	42	53.499	148.767		27	44 34.79	86.46
17	4	50	22.184	136.764		25	54 17.45	339.97	17	6	45	22.266	148.870		27	43 08.33	96.53
18	4	52	38.948	137.123		25	59 57.42	332.24	18	6	47	51.136	148.964		27	41 31.80	106.63
19	4	54	56.071	137.479		26	05 29.66	324.44	19	6	50	20.100	149.053		27	39 45.17	116.73
20	4	57	13.550	137.832		26	10 54.10	316.57	20	6	52	49.153	149.132		27	37 48.44	126.87
21	4	59	31.382	138.184		26	16 10.67	308.64	21	6	55	18.285	149.204		27	35 41.57	137.00
22	5	01	49.566	138.532		26	21 19.31	300.64	22	6	57	47.489	149.268		27	33 24.57	147.15
23	5	04	08.098	138.877		+26	26 19.95	+292.57	23	7	00	16.757	149.325		+27	30 57.42	-157.32
August 2									August 4								
0	5	06	26.975	139.219		+26	31 12.52	+284.43	0	7	02	46.082	149.374		+27	28 20.10	-167.48
1	5	08	46.194	139.558		26	35 56.95	276.23	1	7	05	15.456	149.414		27	25 32.62	177.66
2	5	11	05.752	139.893		26	40 33.18	267.96	2	7	07	44.870	149.448		27	22 34.96	187.84
3	5	13	25.645	140.226		26	45 01.14	259.63	3	7	10	14.318	149.474		27	19 27.12	198.01
4	5	15	45.871	140.553		26	49 20.77	251.23	4	7	12	43.792	149.491		27	16 09.11	208.20
5	5	18	06.424	140.878		26	53 32.00	242.77	5	7	15	13.283	149.502		27	12 40.91	218.38
6	5	20	27.302	141.198		26	57 34.77	234.24	6	7	17	42.785	149.504		27	09 02.53	228.55
7	5	22	48.500	141.514		27	01 29.01	225.66	7	7	20	12.289	149.500		27	05 13.98	238.73
8	5	25	10.014	141.827		27	05 14.67	217.01	8	7	22	41.789	149.486		27	01 15.25	248.89
9	5	27	31.841	142.133		27	08 51.68	208.29	9	7	25	11.275	149.467		26	57 06.36	259.04
10	5	29	53.974	142.436		27	12 19.97	199.53	10	7	27	40.742	149.439		26	52 47.32	269.19
11	5	32	16.410	142.735		27	15 39.50	190.69	11	7	30	10.181	149.404		26	48 18.13	279.32
12	5	34	39.145	143.028		27	18 50.19	181.81	12	7	32	39.585	149.362		26	43 38.81	289.44
13	5	37	02.173	143.315		27	21 52.00	172.85	13	7	35	08.947	149.313		26	38 49.37	299.54
14	5	39	25.488	143.599		27	24 44.85	163.86	14	7	37	38.260	149.256		26	33 49.83	309.62
15	5	41	49.087	143.877		27	27 28.71	154.79	15	7	40	07.516	149.192		26	28 40.21	319.68
16	5	44	12.964	144.149		27	30 03.50	145.68	16	7	42	36.708	149.121		26	23 20.53	329.73
17	5	46	37.113	144.416		27	32 29.18	136.51	17	7	45	05.829	149.044		26	17 50.80	339.74
18	5	49	01.529	144.678		27	34 45.69	127.28	18	7	47	34.873	148.959		26	12 11.06	349.73
19	5	51	26.207	144.932		27	36 52.97	118.01	19	7	50	03.832	148.867		26	06 21.33	359.70
20	5	53	51.139	145.182		27	38 50.98	108.69	20	7	52	32.699	148.770		26	00 21.63	369.63
21	5	56	16.321	145.425		27	40 39.67	99.31	21	7	55	01.469	148.665		25	54 12.00	379.54
22	5	58	41.746	145.663		27	42 18.98	89.89	22	7	57	30.134	148.555		25	47 52.46	389.41
23	6	01	07.409	145.893		27	43 48.87	+80.42	23	7	59	58.689	148.437		25	41 23.05	-399.24
24	6	03	33.302			+27	45 09.29		24	8	02	27.126			+25	34 43.81	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 5			August 7		
0	8 02 27.126 ^{h m s}	+25 34 43.81 ^{° ' "}	0	9 57 24.373 ^{h m s}	+17 20 22.03 ^{° ' "}
1	8 04 55.439 ^{148.313}	25 27 54.77 ^{-409.04}	1	9 59 42.230 ^{137.857}	17 06 54.44 ^{-807.59}
2	8 07 23.623 ^{148.184}	25 20 55.97 ^{418.80}	2	10 01 59.836 ^{137.606}	16 53 20.53 ^{813.91}
3	8 09 51.671 ^{148.048}	25 13 47.44 ^{428.53}	3	10 04 17.192 ^{137.356}	16 39 40.37 ^{820.16}
4	8 12 19.578 ^{147.907}	25 06 29.23 ^{438.21}	4	10 06 34.300 ^{137.108}	16 25 54.07 ^{826.30}
5	8 14 47.337 ^{147.759}	24 59 01.39 ^{447.84}	5	10 08 51.160 ^{136.860}	16 12 01.72 ^{832.35}
6	8 17 14.944 ^{147.607}	24 51 23.96 ^{457.43}	6	10 11 07.774 ^{136.614}	15 58 03.41 ^{838.31}
7	8 19 42.393 ^{147.449}	24 43 36.98 ^{466.98}	7	10 13 24.144 ^{136.370}	15 43 59.25 ^{844.16}
8	8 22 09.678 ^{147.285}	24 35 40.50 ^{476.48}	8	10 15 40.272 ^{136.128}	15 29 49.32 ^{849.93}
9	8 24 36.795 ^{147.117}	24 27 34.57 ^{485.93}	9	10 17 56.158 ^{135.886}	15 15 33.72 ^{855.60}
10	8 27 03.738 ^{146.943}	24 19 19.25 ^{495.32}	10	10 20 11.805 ^{135.647}	15 01 12.56 ^{861.16}
11	8 29 30.502 ^{146.764}	24 10 54.59 ^{504.66}	11	10 22 27.215 ^{135.410}	14 46 45.92 ^{866.64}
12	8 31 57.083 ^{146.581}	24 02 20.64 ^{513.95}	12	10 24 42.390 ^{135.175}	14 32 13.90 ^{872.02}
13	8 34 23.475 ^{146.392}	23 53 37.45 ^{523.19}	13	10 26 57.332 ^{134.942}	14 17 36.61 ^{877.29}
14	8 36 49.676 ^{146.201}	23 44 45.09 ^{532.36}	14	10 29 12.043 ^{134.711}	14 02 54.14 ^{882.47}
15	8 39 15.679 ^{146.003}	23 35 43.61 ^{541.48}	15	10 31 26.527 ^{134.484}	13 48 06.59 ^{887.55}
16	8 41 41.482 ^{145.803}	23 26 33.08 ^{550.53}	16	10 33 40.784 ^{134.257}	13 33 14.06 ^{892.53}
17	8 44 07.079 ^{145.597}	23 17 13.55 ^{559.53}	17	10 35 54.819 ^{134.035}	13 18 16.65 ^{897.41}
18	8 46 32.468 ^{145.389}	23 07 45.10 ^{568.45}	18	10 38 08.633 ^{133.814}	13 03 14.45 ^{902.20}
19	8 48 57.645 ^{145.177}	22 58 07.78 ^{577.32}	19	10 40 22.229 ^{133.596}	12 48 07.57 ^{906.88}
20	8 51 22.606 ^{144.961}	22 48 21.65 ^{586.13}	20	10 42 35.611 ^{133.382}	12 32 56.10 ^{911.47}
21	8 53 47.347 ^{144.741}	22 38 26.80 ^{594.85}	21	10 44 48.781 ^{133.170}	12 17 40.14 ^{915.96}
22	8 56 11.865 ^{144.518}	22 28 23.28 ^{603.52}	22	10 47 01.742 ^{132.961}	12 02 19.80 ^{920.34}
23	8 58 36.159 ^{144.294}	+22 18 11.17 ^{612.11}	23	10 49 14.497 ^{132.755}	+11 46 55.18 ^{924.62}
		-620.64			-928.82
August 6			August 8		
0	9 01 00.223 ^{143.833}	+22 07 50.53 ^{-629.08}	0	10 51 27.050 ^{132.354}	+11 31 26.36 ^{-932.89}
1	9 03 24.056 ^{143.599}	21 57 21.45 ^{637.46}	1	10 53 39.404 ^{132.158}	11 15 53.47 ^{936.89}
2	9 05 47.655 ^{143.363}	21 46 43.99 ^{645.77}	2	10 55 51.562 ^{131.966}	11 00 16.58 ^{940.77}
3	9 08 11.018 ^{143.125}	21 35 58.22 ^{653.99}	3	10 58 03.528 ^{131.777}	10 44 35.81 ^{944.55}
4	9 10 34.143 ^{142.883}	21 25 04.23 ^{662.15}	4	11 00 15.305 ^{131.592}	10 28 51.26 ^{948.24}
5	9 12 57.026 ^{142.641}	21 14 02.08 ^{670.21}	5	11 02 26.897 ^{131.410}	10 13 03.02 ^{951.82}
6	9 15 19.667 ^{142.397}	21 02 51.87 ^{678.21}	6	11 04 38.307 ^{131.232}	9 57 11.20 ^{955.31}
7	9 17 42.064 ^{142.150}	20 51 33.66 ^{686.12}	7	11 06 49.539 ^{131.058}	9 41 15.89 ^{958.69}
8	9 20 04.214 ^{141.903}	20 40 07.54 ^{693.96}	8	11 09 00.597 ^{130.888}	9 25 17.20 ^{961.97}
9	9 22 26.117 ^{141.653}	20 28 33.58 ^{701.71}	9	11 11 11.485 ^{130.722}	9 09 15.23 ^{965.15}
10	9 24 47.770 ^{141.404}	20 16 51.87 ^{709.37}	10	11 13 22.207 ^{130.559}	8 53 10.08 ^{968.24}
11	9 27 09.174 ^{141.152}	20 05 02.50 ^{716.96}	11	11 15 32.766 ^{130.401}	8 37 01.84 ^{971.22}
12	9 29 30.326 ^{140.900}	19 53 05.54 ^{724.46}	12	11 17 43.167 ^{130.247}	8 20 50.62 ^{974.10}
13	9 31 51.226 ^{140.647}	19 41 01.08 ^{731.87}	13	11 19 53.414 ^{130.097}	8 04 36.52 ^{976.88}
14	9 34 11.873 ^{140.393}	19 28 49.21 ^{739.20}	14	11 22 03.511 ^{129.951}	7 48 19.64 ^{979.56}
15	9 36 32.266 ^{140.140}	19 16 30.01 ^{746.44}	15	11 24 13.462 ^{129.809}	7 32 00.08 ^{982.14}
16	9 38 52.406 ^{139.885}	19 04 03.57 ^{753.60}	16	11 26 23.271 ^{129.672}	7 15 37.94 ^{984.62}
17	9 41 12.291 ^{139.631}	18 51 29.97 ^{760.66}	17	11 28 32.943 ^{129.539}	6 59 13.32 ^{987.00}
18	9 43 31.922 ^{139.377}	18 38 49.31 ^{767.63}	18	11 30 42.482 ^{129.410}	6 42 46.32 ^{989.28}
19	9 45 51.299 ^{139.122}	18 26 01.68 ^{774.52}	19	11 32 51.892 ^{129.286}	6 26 17.04 ^{991.46}
20	9 48 10.421 ^{138.868}	18 13 07.16 ^{781.32}	20	11 35 01.178 ^{129.166}	6 09 45.58 ^{993.53}
21	9 50 29.289 ^{138.614}	18 00 05.84 ^{788.02}	21	11 37 10.344 ^{129.052}	5 53 12.05 ^{995.52}
22	9 52 47.903 ^{138.361}	17 46 57.82 ^{794.64}	22	11 39 19.396 ^{128.940}	5 36 36.53 ^{997.40}
23	9 55 06.264 ^{138.109}	17 33 43.18 ^{-801.15}	23	11 41 28.336 ^{128.835}	5 19 59.13 ^{-999.18}
24	9 57 24.373	+17 20 22.03	24	11 43 37.171	+5 03 19.95

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination			
August 9							August 11							
b	h	m	s	°	'	"	b	h	m	s	°	'	"	
0	11	43	37.171	128.733	+	5 03 19.95	1000.87	0	13	26	11.992	129.643	-	8 18 56.28
1	11	45	45.904	128.637		4 46 39.08	1002.44	1	13	28	21.635	129.783		8 35 03.52
2	11	47	54.541	128.544		4 29 56.64	1003.93	2	13	30	31.418	129.927		8 51 07.74
3	11	50	03.085	128.457		4 13 12.71	1005.31	3	13	32	41.345	130.074		9 07 08.84
4	11	52	11.542	128.375		3 56 27.40	1006.59	4	13	34	51.419	130.228		9 23 06.73
5	11	54	19.917	128.296		3 39 40.81	1007.78	5	13	37	01.647	130.384		9 39 01.32
6	11	56	28.213	128.224		3 22 53.03	1008.87	6	13	39	12.031	130.547		9 54 52.50
7	11	58	36.437	128.156		3 06 04.16	1009.86	7	13	41	22.578	130.712		10 10 40.20
8	12	00	44.593	128.092		2 49 14.30	1010.74	8	13	43	33.290	130.883		10 26 24.32
9	12	02	52.685	128.034		2 32 23.56	1011.54	9	13	45	44.173	131.058		10 42 04.76
10	12	05	00.719	127.980		2 15 32.02	1012.23	10	13	47	55.231	131.237		10 57 41.43
11	12	07	08.699	127.932		1 58 39.79	1012.83	11	13	50	06.468	131.419		11 13 14.25
12	12	09	16.631	127.888		1 41 46.96	1013.33	12	13	52	17.887	131.608		11 28 43.11
13	12	11	24.519	127.849		1 24 53.63	1013.72	13	13	54	29.495	131.798		11 44 07.93
14	12	13	32.368	127.816		1 07 59.91	1014.03	14	13	56	41.293	131.994		11 59 28.62
15	12	15	40.184	127.787		0 51 05.88	1014.23	15	13	58	53.287	132.193		12 14 45.08
16	12	17	47.971	127.763		0 34 11.65	1014.34	16	14	01	05.480	132.396		12 29 57.23
17	12	19	55.734	127.744		0 17 17.31	1014.35	17	14	03	17.876	132.603		12 45 04.97
18	12	22	03.478	127.730	+	0 00 22.96	1014.27	18	14	05	30.479	132.815		13 00 08.20
19	12	24	11.208	127.722	-	0 16 31.31	1014.07	19	14	07	43.294	133.028		13 15 06.85
20	12	26	18.930	127.718		0 33 25.38	1013.80	20	14	09	56.322	133.247		13 30 00.82
21	12	28	26.648	127.720		0 50 19.18	1013.43	21	14	12	09.569	133.468		13 44 50.01
22	12	30	34.368	127.726		1 07 12.61	1012.95	22	14	14	23.037	133.694		13 59 34.34
23	12	32	42.094	127.737	-	1 24 05.56	1012.38	23	14	16	36.731	133.922	-	14 14 13.71
August 10							August 12							
0	12	34	49.831	127.754	-	1 40 57.94	1011.71	0	14	18	50.653	134.154	-	14 28 48.05
1	12	36	57.585	127.775		1 57 49.65	1010.95	1	14	21	04.807	134.389		14 43 17.24
2	12	39	05.360	127.802		2 14 40.60	1010.10	2	14	23	19.196	134.627		14 57 41.22
3	12	41	13.162	127.833		2 31 30.70	1009.14	3	14	25	33.823	134.868		15 11 59.88
4	12	43	20.995	127.870		2 48 19.84	1008.09	4	14	27	48.691	135.113		15 26 13.13
5	12	45	28.865	127.912		3 05 07.93	1006.95	5	14	30	03.804	135.359		15 40 20.89
6	12	47	36.777	127.959		3 21 54.88	1005.71	6	14	32	19.163	135.610		15 54 23.07
7	12	49	44.736	128.010		3 38 40.59	1004.37	7	14	34	34.773	135.862		16 08 19.57
8	12	51	52.746	128.067		3 55 24.96	1002.95	8	14	36	50.635	136.117		16 22 10.32
9	12	54	00.813	128.129		4 12 07.91	1001.42	9	14	39	06.752	136.375		16 35 55.21
10	12	56	08.942	128.196		4 28 49.33	999.80	10	14	41	23.127	136.635		16 49 34.17
11	12	58	17.138	128.267		4 45 29.13	998.08	11	14	43	39.762	136.898		17 03 07.09
12	13	00	25.405	128.344		5 02 07.21	996.28	12	14	45	56.660	137.161		17 16 33.91
13	13	02	33.749	128.425		5 18 43.49	994.38	13	14	48	13.821	137.428		17 29 54.52
14	13	04	42.174	128.512		5 35 17.87	992.38	14	14	50	31.249	137.697		17 43 08.84
15	13	06	50.686	128.604		5 51 50.25	990.28	15	14	52	48.946	137.967		17 56 16.78
16	13	08	59.290	128.700		6 08 20.53	988.10	16	14	55	06.913	138.239		18 09 18.25
17	13	11	07.990	128.801		6 24 48.63	985.82	17	14	57	25.152	138.513		18 22 13.18
18	13	13	16.791	128.907		6 41 14.45	983.45	18	14	59	43.665	138.787		18 35 01.47
19	13	15	25.698	129.018		6 57 37.90	980.98	19	15	02	02.452	139.065		18 47 43.03
20	13	17	34.716	129.134		7 13 58.88	978.43	20	15	04	21.517	139.341		19 00 17.78
21	13	19	43.850	129.254		7 30 17.31	975.76	21	15	06	40.858	139.621		19 12 45.64
22	13	21	53.104	129.379		7 46 33.07	973.02	22	15	09	00.479	139.900		19 25 06.52
23	13	24	02.483	129.509		8 02 46.09	970.19	23	15	11	20.379	140.180		19 37 20.34
24	13	26	11.992		-	8 18 56.28		24	15	13	40.559		-	19 49 27.00

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 13			August 15		
^h 0	^h 15 ^m 13 ^s 40.559 ^s 140.462	-19 49 27.00 -719.44	^h 0	^h 17 ^m 10 ^s 56.962 ^s 151.701	-26 45 53.32 -288.19
1	15 16 01.021 140.743	20 01 26.44 712.12	1	17 13 28.663 151.823	26 50 41.51 277.89
2	15 18 21.764 141.025	20 13 18.56 704.72	2	17 16 00.486 151.937	26 55 19.40 267.55
3	15 20 42.789 141.308	20 25 03.28 697.24	3	17 18 32.423 152.044	26 59 46.95 257.20
4	15 23 04.097 141.590	20 36 40.52 689.68	4	17 21 04.467 152.144	27 04 04.15 246.81
5	15 25 25.687 141.872	20 48 10.20 682.04	5	17 23 36.611 152.237	27 08 10.96 236.40
6	15 27 47.559 142.155	20 59 32.24 674.31	6	17 26 08.848 152.322	27 12 07.36 225.96
7	15 30 09.714 142.437	21 10 46.55 666.51	7	17 28 41.170 152.399	27 15 53.32 215.51
8	15 32 32.151 142.718	21 21 53.06 658.62	8	17 31 13.569 152.470	27 19 28.83 205.03
9	15 34 54.869 142.998	21 32 51.68 650.67	9	17 33 46.039 152.531	27 22 53.86 194.54
10	15 37 17.867 143.279	21 43 42.35 642.62	10	17 36 18.570 152.586	27 26 08.40 184.04
11	15 39 41.146 143.558	21 54 24.97 634.50	11	17 38 51.156 152.632	27 29 12.44 173.50
12	15 42 04.704 143.836	22 04 59.47 626.31	12	17 41 23.788 152.670	27 32 05.94 162.98
13	15 44 28.540 144.112	22 15 25.78 618.04	13	17 43 56.458 152.701	27 34 48.92 152.43
14	15 46 52.652 144.387	22 25 43.82 609.69	14	17 46 29.159 152.723	27 37 21.35 141.88
15	15 49 17.039 144.661	22 35 53.51 601.27	15	17 49 01.882 152.737	27 39 43.23 131.31
16	15 51 41.700 144.933	22 45 54.78 592.78	16	17 51 34.619 152.743	27 41 54.54 120.75
17	15 54 06.633 145.203	22 55 47.56 584.21	17	17 54 07.362 152.741	27 43 55.29 110.19
18	15 56 31.836 145.470	23 05 31.77 575.57	18	17 56 40.103 152.730	27 45 45.48 99.62
19	15 58 57.306 145.736	23 15 07.34 566.85	19	17 59 12.833 152.711	27 47 25.10 89.05
20	16 01 23.042 145.999	23 24 34.19 558.08	20	18 01 45.544 152.684	27 48 54.15 78.49
21	16 03 49.041 146.260	23 33 52.27 549.22	21	18 04 18.228 152.648	27 50 12.64 67.93
22	16 06 15.301 146.517	23 43 01.49 540.31	22	18 06 50.876 152.604	27 51 20.57 57.38
23	16 08 41.818 146.772	-23 52 01.80 -531.31	23	18 09 23.480 152.552	-27 52 17.95 -46.84
August 14			August 16		
0	16 11 08.590 147.023	-24 00 53.11 -522.27	0	18 11 56.032 152.490	-27 53 04.79 -36.31
1	16 13 35.613 147.272	24 09 35.38 513.14	1	18 14 28.522 152.422	27 53 41.10 25.79
2	16 16 02.885 147.517	24 18 08.52 503.96	2	18 17 00.944 152.344	27 54 06.89 15.28
3	16 18 30.402 147.758	24 26 32.48 494.72	3	18 19 33.288 152.258	27 54 22.17 4.79
4	16 20 58.160 147.996	24 34 47.20 485.40	4	18 22 05.546 152.165	27 54 26.96 + 5.67
5	16 23 26.156 148.229	24 42 52.60 476.04	5	18 24 37.711 152.061	27 54 21.29 16.13
6	16 25 54.385 148.458	24 50 48.64 466.61	6	18 27 09.772 151.951	27 54 05.16 26.55
7	16 28 22.843 148.684	24 58 35.25 457.11	7	18 29 41.723 151.832	27 53 38.61 36.95
8	16 30 51.527 148.904	25 06 12.36 447.58	8	18 32 13.555 151.706	27 53 01.66 47.33
9	16 33 20.431 149.121	25 13 39.94 437.97	9	18 34 45.261 151.569	27 52 14.33 57.68
10	16 35 49.552 149.331	25 20 57.91 428.32	10	18 37 16.830 151.427	27 51 16.65 68.01
11	16 38 18.883 149.538	25 28 06.23 418.60	11	18 39 48.257 151.275	27 50 08.64 78.29
12	16 40 48.421 149.740	25 35 04.83 408.85	12	18 42 19.532 151.116	27 48 50.35 88.55
13	16 43 18.161 149.935	25 41 53.68 399.04	13	18 44 50.648 150.950	27 47 21.80 98.77
14	16 45 48.096 150.126	25 48 32.72 389.17	14	18 47 21.598 150.774	27 45 43.03 108.96
15	16 48 18.222 150.311	25 55 01.89 379.26	15	18 49 52.372 150.592	27 43 54.07 119.11
16	16 50 48.533 150.490	26 01 21.15 369.31	16	18 52 22.964 150.401	27 41 54.96 129.21
17	16 53 19.023 150.663	26 07 30.46 359.31	17	18 54 53.365 150.205	27 39 45.75 139.28
18	16 55 49.686 150.831	26 13 29.77 349.27	18	18 57 23.570 149.999	27 37 26.47 149.31
19	16 58 20.517 150.992	26 19 19.04 339.18	19	18 59 53.569 149.786	27 34 57.16 159.28
20	17 00 51.509 151.147	26 24 58.22 329.06	20	19 02 23.355 149.568	27 32 17.88 169.22
21	17 03 22.656 151.296	26 30 27.28 318.89	21	19 04 52.923 149.340	27 29 28.66 179.10
22	17 05 53.952 151.437	26 35 46.17 308.70	22	19 07 22.263 149.107	27 26 29.56 188.94
23	17 08 25.389 151.573	26 40 54.87 -298.45	23	19 09 51.370 148.866	27 23 20.62 +198.73
24	17 10 56.962 151.701	-26 45 53.32 -288.19	24	19 12 20.236 148.614	-27 20 01.89 -277.89

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
August 17							August 19						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	19	12	20.236	148.619	-27	20 01.89	0	21	05	04.003	131.694	-21	50 37.46
1	19	14	48.855	148.365	27	16 33.43	1	21	07	15.697	131.297	21	40 43.55
2	19	17	17.220	148.105	27	12 55.29	2	21	09	26.994	130.902	21	30 43.56
3	19	19	45.325	147.838	27	09 07.53	3	21	11	37.896	130.508	21	20 37.58
4	19	22	13.163	147.565	27	05 10.20	4	21	13	48.404	130.114	21	10 25.70
5	19	24	40.728	147.286	27	01 03.36	5	21	15	58.518	129.721	21	00 07.98
6	19	27	08.014	147.001	26	56 47.07	6	21	18	08.239	129.329	20	49 44.52
7	19	29	35.015	146.710	26	52 21.38	7	21	20	17.568	128.939	20	39 15.41
8	19	32	01.725	146.413	26	47 46.37	8	21	22	26.507	128.550	20	28 40.71
9	19	34	28.138	146.112	26	43 02.08	9	21	24	35.057	128.161	20	18 00.52
10	19	36	54.250	145.804	26	38 08.60	10	21	26	43.218	127.775	20	07 14.92
11	19	39	20.054	145.492	26	33 05.98	11	21	28	50.993	127.390	19	56 23.99
12	19	41	45.546	145.174	26	27 54.28	12	21	30	58.383	127.007	19	45 27.81
13	19	44	10.720	144.851	26	22 33.58	13	21	33	05.390	126.626	19	34 26.46
14	19	46	35.571	144.524	26	17 03.95	14	21	35	12.016	126.245	19	23 20.02
15	19	49	00.095	144.192	26	11 25.45	15	21	37	18.261	125.869	19	12 08.58
16	19	51	24.287	143.856	26	05 38.15	16	21	39	24.130	125.492	19	00 52.22
17	19	53	48.143	143.515	25	59 42.12	17	21	41	29.622	125.119	18	49 31.01
18	19	56	11.658	143.171	25	53 37.45	18	21	43	34.741	124.748	18	38 05.04
19	19	58	34.829	142.822	25	47 24.19	19	21	45	39.489	124.378	18	26 34.39
20	20	00	57.651	142.469	25	41 02.42	20	21	47	43.867	124.012	18	14 59.13
21	20	03	20.120	142.113	25	34 32.22	21	21	49	47.879	123.647	18	03 19.34
22	20	05	42.233	141.754	25	27 53.67	22	21	51	51.526	123.286	17	51 35.11
23	20	08	03.987	141.391	-25	21 06.83	23	21	53	54.812	122.927	-17	39 46.51
August 18							August 20						
0	20	10	25.378	141.024	-25	14 11.79	0	21	55	57.739	122.570	-17	27 53.61
1	20	12	46.402	140.656	25	07 08.62	1	21	58	00.309	122.216	17	15 56.50
2	20	15	07.058	140.283	24	59 57.40	2	22	00	02.525	121.866	17	03 55.26
3	20	17	27.341	139.909	24	52 38.21	3	22	02	04.391	121.517	16	51 49.95
4	20	19	47.250	139.532	24	45 11.13	4	22	04	05.908	121.172	16	39 40.66
5	20	22	06.782	139.153	24	37 36.23	5	22	06	07.080	120.829	16	27 27.46
6	20	24	25.935	138.771	24	29 53.61	6	22	08	07.909	120.491	16	15 10.42
7	20	26	44.706	138.387	24	22 03.33	7	22	10	08.400	120.154	16	02 49.63
8	20	29	03.093	138.001	24	14 05.48	8	22	12	08.554	119.822	15	50 25.15
9	20	31	21.094	137.614	24	06 00.14	9	22	14	08.376	119.491	15	37 57.06
10	20	33	38.708	137.225	23	57 47.40	10	22	16	07.867	119.165	15	25 25.43
11	20	35	55.933	136.835	23	49 27.33	11	22	18	07.032	118.842	15	12 50.33
12	20	38	12.768	136.443	23	41 00.01	12	22	20	05.874	118.522	15	00 11.85
13	20	40	29.211	136.050	23	32 25.53	13	22	22	04.396	118.206	14	47 30.04
14	20	42	45.261	135.656	23	23 43.98	14	22	24	02.602	117.892	14	34 44.98
15	20	45	00.917	135.261	23	14 55.43	15	22	26	00.494	117.583	14	21 56.75
16	20	47	16.178	134.866	23	05 59.97	16	22	27	58.077	117.277	14	09 05.40
17	20	49	31.044	134.470	22	56 57.68	17	22	29	55.354	116.974	13	56 11.02
18	20	51	45.514	134.074	22	47 48.64	18	22	31	52.328	116.675	13	43 13.67
19	20	53	59.588	133.677	22	38 32.95	19	22	33	49.003	116.380	13	30 13.42
20	20	56	13.265	133.280	22	29 10.67	20	22	35	45.383	116.089	13	17 10.34
21	20	58	26.545	132.883	22	19 41.90	21	22	37	41.472	115.800	13	04 04.50
22	21	00	39.428	132.486	22	10 06.72	22	22	39	37.272	115.516	12	50 55.96
23	21	02	51.914	132.089	22	00 25.21	23	22	41	32.788	115.236	12	37 44.79
24	21	05	04.003		-21	50 37.46	24	22	43	28.024		-12	24 31.06

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 21			August 23		
^h ^m ^s	[°] ['] ["]	[°] ['] ["]	^h ^m ^s	[°] ['] ["]	[°] ['] ["]
0	22 43 28.024	-12 24 31.06	0	0 11 28.243	-1 19 04.49
1	22 45 22.983	12 11 14.84	1	0 13 14.716	1 04 57.06
2	22 47 17.670	11 57 56.18	2	0 15 01.117	0 50 49.83
3	22 49 12.087	11 44 35.16	3	0 16 47.447	0 36 42.84
4	22 51 06.239	11 31 11.84	4	0 18 33.713	0 22 36.14
5	22 53 00.130	11 17 46.28	5	0 20 19.919	0 08 29.78
6	22 54 53.764	11 04 18.54	6	0 22 06.067	0 05 36.21
7	22 56 47.144	10 50 48.70	7	0 23 52.164	0 19 41.76
8	22 58 40.275	10 37 16.81	8	0 25 38.213	0 33 46.85
9	23 00 33.161	10 23 42.93	9	0 27 24.217	0 47 51.42
10	23 02 25.805	10 10 07.13	10	0 29 10.183	1 01 55.43
11	23 04 18.212	9 56 29.47	11	0 30 56.113	1 15 58.83
12	23 06 10.385	9 42 50.00	12	0 32 42.012	1 30 01.59
13	23 08 02.329	9 29 08.79	13	0 34 27.885	1 44 03.66
14	23 09 54.048	9 15 25.90	14	0 36 13.735	1 58 04.99
15	23 11 45.546	9 01 41.38	15	0 37 59.566	2 12 05.54
16	23 13 36.827	8 47 55.30	16	0 39 45.384	2 26 05.26
17	23 15 27.895	8 34 07.72	17	0 41 31.191	2 40 04.12
18	23 17 18.754	8 20 18.69	18	0 43 16.994	2 54 02.08
19	23 19 09.409	8 06 28.26	19	0 45 02.794	3 07 59.07
20	23 20 59.863	7 52 36.51	20	0 46 48.598	3 21 55.08
21	23 22 50.120	7 38 43.47	21	0 48 34.409	3 35 50.04
22	23 24 40.186	7 24 49.22	22	0 50 20.230	3 49 43.93
23	23 26 30.063	7 10 53.80	23	0 52 06.068	4 03 36.69
		+836.53			+831.59
August 22			August 24		
^h ^m ^s	[°] ['] ["]	[°] ['] ["]	^h ^m ^s	[°] ['] ["]	[°] ['] ["]
0	23 28 19.757	-6 56 57.27	0	0 53 51.925	+4 17 28.28
1	23 30 09.271	6 42 59.68	1	0 55 37.806	4 31 18.67
2	23 31 58.609	6 29 01.10	2	0 57 23.715	4 45 07.80
3	23 33 47.777	6 15 01.57	3	0 59 09.656	4 58 55.65
4	23 35 36.777	6 01 01.14	4	1 00 55.634	5 12 42.16
5	23 37 25.615	5 46 59.88	5	1 02 41.652	5 26 27.29
6	23 39 14.294	5 32 57.83	6	1 04 27.715	5 40 11.00
7	23 41 02.818	5 18 55.05	7	1 06 13.827	5 53 53.25
8	23 42 51.193	5 04 51.58	8	1 07 59.992	6 07 34.00
9	23 44 39.422	4 50 47.48	9	1 09 46.215	6 21 13.21
10	23 46 27.509	4 36 42.81	10	1 11 32.499	6 34 50.82
11	23 48 15.459	4 22 37.60	11	1 13 18.849	6 48 26.81
12	23 50 03.276	4 08 31.92	12	1 15 05.268	7 02 01.13
13	23 51 50.963	3 54 25.81	13	1 16 51.761	7 15 33.74
14	23 53 38.527	3 40 19.33	14	1 18 38.333	7 29 04.59
15	23 55 25.970	3 26 12.52	15	1 20 24.986	7 42 33.65
16	23 57 13.296	3 12 05.42	16	1 22 11.726	7 56 00.87
17	23 59 00.511	2 57 58.10	17	1 23 58.556	8 09 26.21
18	0 00 47.619	2 43 50.60	18	1 25 45.481	8 22 49.62
19	0 02 34.623	2 29 42.97	19	1 27 32.504	8 36 11.08
20	0 04 21.528	2 15 35.25	20	1 29 19.630	8 49 30.52
21	0 06 08.338	2 01 27.50	21	1 31 06.863	9 02 47.92
22	0 07 55.058	1 47 19.75	22	1 32 54.207	9 16 03.23
23	0 09 41.691	1 33 12.07	23	1 34 41.666	9 29 16.41
24	0 11 28.243	1 19 04.49	24	1 36 29.243	9 42 27.41
		+847.58			+791.00

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
August 25									August 27										
h	h	m	s		°	'	"		h	h	m	s		°	'	"			
0	1	36	29.243	107.701	+	9	42	27.41	+788.78	0	3	06	09.048	118.062	+	19	18	06.57	+628.83
1	1	38	16.944	107.827		9	55	36.19	786.52	1	3	08	07.110	118.361		19	28	35.40	624.28
2	1	40	04.771	107.959		10	08	42.71	784.22	2	3	10	05.471	118.661		19	38	59.68	619.67
3	1	41	52.730	108.094		10	21	46.93	781.87	3	3	12	04.132	118.966		19	49	19.35	615.06
4	1	43	40.824	108.233		10	34	48.80	779.49	4	3	14	03.098	119.272		19	59	34.37	610.30
5	1	45	29.057	108.376		10	47	48.29	777.05	5	3	16	02.370	119.582		20	09	44.67	605.52
6	1	47	17.433	108.524		11	00	45.34	774.58	6	3	18	01.952	119.893		20	19	50.19	600.70
7	1	49	05.957	108.674		11	13	39.92	772.06	7	3	20	01.845	120.207		20	29	50.89	595.82
8	1	50	54.631	108.830		11	26	31.98	769.49	8	3	22	02.052	120.524		20	39	46.71	590.88
9	1	52	43.461	108.988		11	39	21.47	766.89	9	3	24	02.576	120.842		20	49	37.59	585.87
10	1	54	32.449	109.152		11	52	08.36	764.25	10	3	26	03.418	121.164		20	59	23.46	580.83
11	1	56	21.601	109.318		12	04	52.61	761.54	11	3	28	04.582	121.487		21	09	04.29	575.71
12	1	58	10.919	109.489		12	17	34.15	758.81	12	3	30	06.069	121.813		21	18	40.00	570.54
13	2	00	00.408	109.664		12	30	12.96	756.03	13	3	32	07.882	122.140		21	28	10.54	565.31
14	2	01	50.072	109.842		12	42	48.99	753.20	14	3	34	10.022	122.470		21	37	35.85	560.02
15	2	03	39.914	110.025		12	55	22.19	750.33	15	3	36	12.492	122.802		21	46	55.87	554.67
16	2	05	29.939	110.211		13	07	52.52	747.42	16	3	38	15.294	123.134		21	56	10.54	549.27
17	2	07	20.150	110.401		13	20	19.94	744.45	17	3	40	18.428	123.470		22	05	19.81	543.80
18	2	09	10.551	110.595		13	32	44.39	741.45	18	3	42	21.898	123.807		22	14	23.61	538.28
19	2	11	01.146	110.792		13	45	05.84	738.39	19	3	44	25.705	124.145		22	23	21.89	532.69
20	2	12	51.938	110.994		13	57	24.23	735.30	20	3	46	29.850	124.486		22	32	14.58	527.04
21	2	14	42.932	111.200		14	09	39.53	732.15	21	3	48	34.336	124.827		22	41	01.62	521.34
22	2	16	34.132	111.408		14	21	51.68	728.96	22	3	50	39.163	125.169		22	49	42.96	515.56
23	2	18	25.540	111.621		+14	34	00.64	+725.72	23	3	52	44.332	125.514		+22	58	18.52	+509.74
August 26									August 28										
0	2	20	17.161	111.838		+14	46	06.36	+722.44	0	3	54	49.846	125.859		+23	06	48.26	+503.85
1	2	22	08.999	112.057		14	58	08.80	719.10	1	3	56	55.705	126.206		23	15	12.11	497.90
2	2	24	01.056	112.281		15	10	07.90	715.73	2	3	59	01.911	126.553		23	23	30.01	491.88
3	2	25	53.337	112.508		15	22	03.63	712.30	3	4	01	08.464	126.902		23	31	41.89	485.80
4	2	27	45.845	112.739		15	33	55.93	708.83	4	4	03	15.366	127.250		23	39	47.69	479.67
5	2	29	38.584	112.974		15	45	44.76	705.31	5	4	05	22.616	127.601		23	47	47.36	473.46
6	2	31	31.558	113.212		15	57	30.07	701.73	6	4	07	30.217	127.951		23	55	40.82	467.20
7	2	33	24.770	113.453		16	09	11.80	698.12	7	4	09	38.168	128.303		24	03	28.02	460.88
8	2	35	18.223	113.698		16	20	49.92	694.45	8	4	11	46.471	128.654		24	11	08.90	454.48
9	2	37	11.921	113.946		16	32	24.37	690.73	9	4	13	55.125	129.005		24	18	43.38	448.03
10	2	39	05.867	114.198		16	43	55.10	686.96	10	4	16	04.130	129.358		24	26	11.41	441.52
11	2	41	00.065	114.454		16	55	22.06	683.14	11	4	18	13.488	129.710		24	33	32.93	434.93
12	2	42	54.519	114.712		17	06	45.20	679.28	12	4	20	23.198	130.062		24	40	47.86	428.30
13	2	44	49.231	114.974		17	18	04.48	675.36	13	4	22	33.260	130.415		24	47	56.16	421.58
14	2	46	44.205	115.239		17	29	19.84	671.39	14	4	24	43.675	130.766		24	54	57.74	414.82
15	2	48	39.444	115.507		17	40	31.23	667.36	15	4	26	54.441	131.118		25	01	52.56	407.98
16	2	50	34.951	115.779		17	51	38.59	663.30	16	4	29	05.559	131.468		25	08	40.54	401.09
17	2	52	30.730	116.054		18	02	41.89	659.18	17	4	31	17.027	131.820		25	15	21.63	394.12
18	2	54	26.784	116.331		18	13	41.07	654.99	18	4	33	28.847	132.169		25	21	55.75	387.10
19	2	56	23.115	116.613		18	24	36.06	650.77	19	4	35	41.016	132.518		25	28	22.85	380.01
20	2	58	19.728	116.897		18	35	26.83	646.49	20	4	37	53.534	132.866		25	34	42.86	372.86
21	3	00	16.625	117.183		18	46	13.32	642.16	21	4	40	06.400	133.213		25	40	55.72	365.64
22	3	02	13.808	117.474		18	56	55.48	637.76	22	4	42	19.613	133.560		25	47	01.36	358.37
23	3	04	11.282	117.766		19	07	33.24	+633.33	23	4	44	33.173	133.904		25	52	59.73	+351.02
24	3	06	09.048			+19	18	06.57		24	4	46	47.077			+25	58	50.75	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
August 29			August 31		
h	h m s	° ' "	h	h m s	° ' "
0	4 46 47.077 ^s	+25 58 50.75	0	6 39 43.252 ^s	+27 56 28.77
1	4 49 01.324 ^{134.247}	26 04 34.36 ^{+343.61}	1	6 42 09.893 ^{146.641}	27 55 11.01 ^{-77.76}
2	4 51 15.913 ^{134.589}	26 10 10.51 ^{336.15}	2	6 44 36.663 ^{146.770}	27 53 43.41 ^{87.60}
3	4 53 30.842 ^{134.929}	26 15 39.12 ^{328.61}	3	6 47 03.555 ^{146.892}	27 52 05.96 ^{97.45}
4	4 55 46.109 ^{135.267}	26 21 00.14 ^{321.02}	4	6 49 30.562 ^{147.007}	27 50 18.63 ^{107.33}
5	4 58 01.712 ^{135.603}	26 26 13.50 ^{313.36}	5	6 51 57.678 ^{147.116}	27 48 21.40 ^{117.23}
6	5 00 17.650 ^{135.938}	26 31 19.14 ^{305.64}	6	6 54 24.895 ^{147.217}	27 46 14.24 ^{127.16}
7	5 02 33.920 ^{136.270}	26 36 16.99 ^{297.85}	7	6 56 52.207 ^{147.312}	27 43 57.15 ^{137.09}
8	5 04 50.520 ^{136.600}	26 41 07.01 ^{290.02}	8	6 59 19.608 ^{147.401}	27 41 30.10 ^{147.05}
9	5 07 07.448 ^{136.928}	26 45 49.12 ^{282.11}	9	7 01 47.090 ^{147.482}	27 38 53.07 ^{157.03}
10	5 09 24.700 ^{137.252}	26 50 23.26 ^{274.14}	10	7 04 14.647 ^{147.557}	27 36 06.06 ^{167.01}
11	5 11 42.274 ^{137.574}	26 54 49.37 ^{266.11}	11	7 06 42.273 ^{147.626}	27 33 09.06 ^{177.00}
12	5 14 00.168 ^{137.894}	26 59 07.39 ^{258.02}	12	7 09 09.959 ^{147.686}	27 30 02.04 ^{187.02}
13	5 16 18.379 ^{138.211}	27 03 17.27 ^{249.88}	13	7 11 37.699 ^{147.740}	27 26 45.00 ^{197.04}
14	5 18 36.902 ^{138.523}	27 07 18.94 ^{241.67}	14	7 14 05.488 ^{147.789}	27 23 17.94 ^{207.06}
15	5 20 55.736 ^{138.834}	27 11 12.34 ^{233.40}	15	7 16 33.317 ^{147.829}	27 19 40.84 ^{217.10}
16	5 23 14.877 ^{139.141}	27 14 57.42 ^{225.08}	16	7 19 01.180 ^{147.863}	27 15 53.71 ^{227.13}
17	5 25 34.322 ^{139.445}	27 18 34.11 ^{216.69}	17	7 21 29.071 ^{147.891}	27 11 56.54 ^{237.17}
18	5 27 54.066 ^{139.744}	27 22 02.36 ^{208.25}	18	7 23 56.982 ^{147.911}	27 07 49.32 ^{247.22}
19	5 30 14.106 ^{140.040}	27 25 22.11 ^{199.75}	19	7 26 24.908 ^{147.926}	27 03 32.07 ^{257.25}
20	5 32 34.438 ^{140.332}	27 28 33.31 ^{191.20}	20	7 28 52.841 ^{147.933}	26 59 04.77 ^{267.30}
21	5 34 55.059 ^{140.621}	27 31 35.90 ^{182.59}	21	7 31 20.774 ^{147.933}	26 54 27.45 ^{277.32}
22	5 37 15.965 ^{140.906}	27 34 29.82 ^{173.92}	22	7 33 48.702 ^{147.928}	26 49 40.09 ^{287.36}
23	5 39 37.150 ^{141.185}	+27 37 15.02 ^{165.20}	23	7 36 16.618 ^{147.916}	+26 44 42.71 ^{297.38}
	141.461	+156.43		147.898	-307.40
August 30			September 1		
h	h m s	° ' "	h	h m s	° ' "
0	5 41 58.611	+27 39 51.45	0	7 38 44.516	+26 39 35.31
1	5 44 20.343 ^{141.732}	27 42 19.05 ^{+147.60}	1	7 41 12.388 ^{147.872}	26 34 17.91 ^{-317.40}
2	5 46 42.342 ^{141.999}	27 44 37.77 ^{138.72}	2	7 43 40.229 ^{147.841}	26 28 50.52 ^{327.39}
3	5 49 04.604 ^{142.262}	27 46 47.55 ^{129.78}	3	7 46 08.033 ^{147.804}	26 23 13.15 ^{337.37}
4	5 51 27.122 ^{142.518}	27 48 48.36 ^{120.81}	4	7 48 35.792 ^{147.759}	26 17 25.82 ^{347.33}
5	5 53 49.893 ^{142.771}	27 50 40.14 ^{111.78}	5	7 51 03.502 ^{147.710}	26 11 28.55 ^{357.27}
6	5 56 12.911 ^{143.018}	27 52 22.83 ^{102.69}	6	7 53 31.156 ^{147.654}	26 05 21.34 ^{367.21}
7	5 58 36.172 ^{143.261}	27 53 56.40 ^{93.57}	7	7 55 58.748 ^{147.592}	25 59 04.23 ^{377.11}
8	6 00 59.670 ^{143.498}	27 55 20.79 ^{84.39}	8	7 58 26.273 ^{147.525}	25 52 37.23 ^{387.00}
9	6 03 23.399 ^{143.729}	27 56 35.96 ^{75.17}	9	8 00 53.724 ^{147.451}	25 46 00.38 ^{396.85}
10	6 05 47.355 ^{143.956}	27 57 41.86 ^{65.90}	10	8 03 21.096 ^{147.372}	25 39 13.69 ^{406.69}
11	6 08 11.531 ^{144.176}	27 58 38.45 ^{56.59}	11	8 05 48.383 ^{147.287}	25 32 17.18 ^{416.51}
12	6 10 35.923 ^{144.392}	27 59 25.69 ^{47.24}	12	8 08 15.580 ^{147.197}	25 25 10.90 ^{426.28}
13	6 13 00.525 ^{144.602}	28 00 03.53 ^{37.84}	13	8 10 42.681 ^{147.101}	25 17 54.87 ^{436.03}
14	6 15 25.330 ^{144.805}	28 00 31.93 ^{28.40}	14	8 13 09.681 ^{147.000}	25 10 29.12 ^{445.75}
15	6 17 50.333 ^{145.003}	28 00 50.86 ^{18.93}	15	8 15 36.575 ^{146.894}	25 02 53.68 ^{455.44}
16	6 20 15.527 ^{145.194}	28 01 00.27 ^{+9.41}	16	8 18 03.358 ^{146.783}	24 55 08.59 ^{465.09}
17	6 22 40.908 ^{145.381}	28 01 00.13 ^{0.14}	17	8 20 30.025 ^{146.667}	24 47 13.89 ^{474.70}
18	6 25 06.468 ^{145.560}	28 00 50.40 ^{9.73}	18	8 22 56.571 ^{146.546}	24 39 09.62 ^{484.27}
19	6 27 32.202 ^{145.734}	28 00 31.04 ^{19.36}	19	8 25 22.991 ^{146.420}	24 30 55.81 ^{493.81}
20	6 29 58.103 ^{145.901}	28 00 02.03 ^{29.01}	20	8 27 49.281 ^{146.290}	24 22 32.50 ^{503.31}
21	6 32 24.165 ^{146.062}	27 59 23.33 ^{38.70}	21	8 30 15.436 ^{146.155}	24 13 59.75 ^{512.75}
22	6 34 50.381 ^{146.216}	27 58 34.90 ^{48.43}	22	8 32 41.452 ^{146.016}	24 05 17.58 ^{522.17}
23	6 37 16.746 ^{146.365}	27 57 36.73 ^{58.17}	23	8 35 07.325 ^{145.873}	23 56 26.06 ^{531.52}
24	6 39 43.252 ^{146.506}	+27 56 28.77 ^{67.96}	24	8 37 33.049 ^{145.724}	+23 47 25.22 ^{-540.84}

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 2			September 4		
0	8 37 33.049 ^s	+23 47 25.22 [°]	0	10 30 27.724 ^s	+13 53 17.48 [°]
1	8 39 58.623 ^s	23 38 15.12 [°]	1	10 32 44.002 ^s	13 38 05.33 [°]
2	8 42 24.041 ^s	23 28 55.81 [°]	2	10 35 00.097 ^s	13 22 47.78 [°]
3	8 44 49.300 ^s	23 19 27.33 [°]	3	10 37 16.011 ^s	13 07 24.94 [°]
4	8 47 14.397 ^s	23 09 49.74 [°]	4	10 39 31.746 ^s	12 51 56.91 [°]
5	8 49 39.327 ^s	23 00 03.10 [°]	5	10 41 47.306 ^s	12 36 23.78 [°]
6	8 52 04.088 ^s	22 50 07.46 [°]	6	10 44 02.693 ^s	12 20 45.67 [°]
7	8 54 28.677 ^s	22 40 02.88 [°]	7	10 46 17.909 ^s	12 05 02.67 [°]
8	8 56 53.089 ^s	22 29 49.42 [°]	8	10 48 32.957 ^s	11 49 14.89 [°]
9	8 59 17.324 ^s	22 19 27.14 [°]	9	10 50 47.841 ^s	11 33 22.43 [°]
10	9 01 41.377 ^s	22 08 56.10 [°]	10	10 53 02.562 ^s	11 17 25.40 [°]
11	9 04 05.246 ^s	21 58 16.37 [°]	11	10 55 17.124 ^s	11 01 23.90 [°]
12	9 06 28.929 ^s	21 47 28.00 [°]	12	10 57 31.531 ^s	10 45 18.04 [°]
13	9 08 52.424 ^s	21 36 31.07 [°]	13	10 59 45.784 ^s	10 29 07.92 [°]
14	9 11 15.727 ^s	21 25 25.64 [°]	14	11 01 59.889 ^s	10 12 53.65 [°]
15	9 13 38.837 ^s	21 14 11.78 [°]	15	11 04 13.846 ^s	9 56 35.34 [°]
16	9 16 01.753 ^s	21 02 49.55 [°]	16	11 06 27.662 ^s	9 40 13.09 [°]
17	9 18 24.472 ^s	20 51 19.04 [°]	17	11 08 41.337 ^s	9 23 47.02 [°]
18	9 20 46.992 ^s	20 39 40.31 [°]	18	11 10 54.877 ^s	9 07 17.22 [°]
19	9 23 09.313 ^s	20 27 53.43 [°]	19	11 13 08.284 ^s	8 50 43.81 [°]
20	9 25 31.432 ^s	20 15 58.48 [°]	20	11 15 21.563 ^s	8 34 06.90 [°]
21	9 27 53.350 ^s	20 03 55.54 [°]	21	11 17 34.717 ^s	8 17 26.59 [°]
22	9 30 15.063 ^s	19 51 44.68 [°]	22	11 19 47.749 ^s	8 00 43.00 [°]
23	9 32 36.572 ^s	+19 39 25.98 [°]	23	11 22 00.664 ^s	+7 43 56.23 [°]
	141.304	-746.47		132.802	-1009.84
September 3			September 5		
0	9 34 57.876 ^s	+19 26 59.51 [°]	0	11 24 13.466 ^s	+7 27 06.39 [°]
1	9 37 18.974 ^s	19 14 25.36 [°]	1	11 26 26.158 ^s	7 10 13.60 [°]
2	9 39 39.865 ^s	19 01 43.61 [°]	2	11 28 38.744 ^s	6 53 17.96 [°]
3	9 42 00.550 ^s	18 48 54.34 [°]	3	11 30 51.228 ^s	6 36 19.59 [°]
4	9 44 21.027 ^s	18 35 57.63 [°]	4	11 33 03.615 ^s	6 19 18.59 [°]
5	9 46 41.297 ^s	18 22 53.57 [°]	5	11 35 15.909 ^s	6 02 15.08 [°]
6	9 49 01.359 ^s	18 09 42.24 [°]	6	11 37 28.113 ^s	5 45 09.16 [°]
7	9 51 21.214 ^s	17 56 23.73 [°]	7	11 39 40.232 ^s	5 28 00.95 [°]
8	9 53 40.862 ^s	17 42 58.12 [°]	8	11 41 52.270 ^s	5 10 50.57 [°]
9	9 56 00.304 ^s	17 29 25.50 [°]	9	11 44 04.231 ^s	4 53 38.11 [°]
10	9 58 19.539 ^s	17 15 45.96 [°]	10	11 46 16.120 ^s	4 36 23.70 [°]
11	10 00 38.568 ^s	17 01 59.60 [°]	11	11 48 27.941 ^s	4 19 07.44 [°]
12	10 02 57.393 ^s	16 48 06.49 [°]	12	11 50 39.699 ^s	4 01 49.46 [°]
13	10 05 16.013 ^s	16 34 06.74 [°]	13	11 52 51.397 ^s	3 44 29.85 [°]
14	10 07 34.431 ^s	16 20 00.43 [°]	14	11 55 03.041 ^s	3 27 08.73 [°]
15	10 09 52.646 ^s	16 05 47.65 [°]	15	11 57 14.634 ^s	3 09 46.22 [°]
16	10 12 10.660 ^s	15 51 28.51 [°]	16	11 59 26.182 ^s	2 52 22.43 [°]
17	10 14 28.475 ^s	15 37 03.08 [°]	17	12 01 37.688 ^s	2 34 57.47 [°]
18	10 16 46.092 ^s	15 22 31.48 [°]	18	12 03 49.158 ^s	2 17 31.45 [°]
19	10 19 03.512 ^s	15 07 53.79 [°]	19	12 06 00.596 ^s	2 00 04.48 [°]
20	10 21 20.737 ^s	14 53 10.12 [°]	20	12 08 12.006 ^s	1 42 36.69 [°]
21	10 23 37.769 ^s	14 38 20.55 [°]	21	12 10 23.393 ^s	1 25 08.17 [°]
22	10 25 54.609 ^s	14 23 25.19 [°]	22	12 12 34.762 ^s	1 07 39.05 [°]
23	10 28 11.260 ^s	14 08 24.13 [°]	23	12 14 46.118 ^s	0 50 09.44 [°]
24	10 30 27.724 ^s	+13 53 17.48 [°]	24	12 16 57.464 ^s	+0 32 39.44 [°]
	136.464	-906.65		131.346	-1050.00

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 6			September 8		
h	^h ^m ^s	[°] ['] ["]	h	^h ^m ^s	[°] ['] ["]
0	12 16 57.464	+ 0 32 39.44	0	14 03 22.290	-12 58 15.05
1	12 19 08.807	+ 0 15 09.18	1	14 05 38.762	13 13 47.50
2	12 21 20.149	- 0 02 21.24	2	14 07 55.439	13 29 14.85
3	12 23 31.497	0 19 51.70	3	14 10 12.325	13 44 37.02
4	12 25 42.854	0 37 22.09	4	14 12 29.423	13 59 53.89
5	12 27 54.227	0 54 52.29	5	14 14 46.735	14 15 05.36
6	12 30 05.618	1 12 22.20	6	14 17 04.265	14 30 11.33
7	12 32 17.033	1 29 51.70	7	14 19 22.014	14 45 11.71
8	12 34 28.477	1 47 20.68	8	14 21 39.987	15 00 06.38
9	12 36 39.954	2 04 49.02	9	14 23 58.185	15 14 55.26
10	12 38 51.470	2 22 16.61	10	14 26 16.611	15 29 38.24
11	12 41 03.028	2 39 43.35	11	14 28 35.267	15 44 15.23
12	12 43 14.634	2 57 09.11	12	14 30 54.155	15 58 46.12
13	12 45 26.292	3 14 33.79	13	14 33 13.278	16 13 10.81
14	12 47 38.007	3 31 57.27	14	14 35 32.638	16 27 29.22
15	12 49 49.783	3 49 19.45	15	14 37 52.237	16 41 41.24
16	12 52 01.626	4 06 40.20	16	14 40 12.076	16 55 46.79
17	12 54 13.540	4 23 59.43	17	14 42 32.158	17 09 45.75
18	12 56 25.529	4 41 17.01	18	14 44 52.484	17 23 38.04
19	12 58 37.599	4 58 32.83	19	14 47 13.055	17 37 23.57
20	13 00 49.753	5 15 46.79	20	14 49 33.873	17 51 02.24
21	13 03 01.997	5 32 58.78	21	14 51 54.939	18 04 33.95
22	13 05 14.335	5 50 08.67	22	14 54 16.254	18 17 58.63
23	13 07 26.771	- 6 07 16.37	23	14 56 37.820	-18 31 16.16
	132.539	-1025.39		141.817	-790.31
September 7			September 9		
0	13 09 39.310	- 6 24 21.76	0	14 58 59.637	-18 44 26.47
1	13 11 51.957	6 41 24.73	1	15 01 21.706	18 57 29.46
2	13 14 04.716	6 58 25.17	2	15 03 44.027	19 10 25.05
3	13 16 17.591	7 15 22.97	3	15 06 06.601	19 23 13.14
4	13 18 30.587	7 32 18.02	4	15 08 29.429	19 35 53.65
5	13 20 43.708	7 49 10.21	5	15 10 52.511	19 48 26.49
6	13 22 56.959	8 05 59.43	6	15 13 15.846	20 00 51.58
7	13 25 10.343	8 22 45.58	7	15 15 39.435	20 13 08.82
8	13 27 23.866	8 39 28.55	8	15 18 03.277	20 25 18.14
9	13 29 37.531	8 56 08.21	9	15 20 27.373	20 37 19.45
10	13 31 51.342	9 12 44.48	10	15 22 51.721	20 49 12.66
11	13 34 05.304	9 29 17.24	11	15 25 16.321	21 00 57.71
12	13 36 19.421	9 45 46.37	12	15 27 41.172	21 12 34.49
13	13 38 33.696	10 02 11.79	13	15 30 06.274	21 24 02.95
14	13 40 48.134	10 18 33.37	14	15 32 31.625	21 35 22.99
15	13 43 02.738	10 34 51.01	15	15 34 57.223	21 46 34.53
16	13 45 17.513	10 51 04.60	16	15 37 23.068	21 57 37.51
17	13 47 32.462	11 07 14.04	17	15 39 49.158	22 08 31.84
18	13 49 47.589	11 23 19.23	18	15 42 15.491	22 19 17.45
19	13 52 02.898	11 39 20.05	19	15 44 42.066	22 29 54.27
20	13 54 18.392	11 55 16.41	20	15 47 08.879	22 40 22.22
21	13 56 34.074	12 11 08.19	21	15 49 35.930	22 50 41.23
22	13 58 49.949	12 26 55.29	22	15 52 03.216	23 00 51.23
23	14 01 06.020	12 42 37.61	23	15 54 30.733	23 10 52.15
24	14 03 22.290	-12 58 15.05	24	15 56 58.480	-23 20 43.92
	136.270	-937.44		147.747	-591.77

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
September 10							September 12						
^h 0	^h 15	^m 56	^s 58.480	[°] 147.974	['] -23	["] 20 43.92	^h 0	^h 17	^m 58	^s 10.176	[°] 152.704	['] -27	["] 58 24.43
1	15	59	26.454	148.198	23	30 26.48	1	18	00	42.880	152.631	27	59 54.58
2	16	01	54.652	148.418	23	39 59.76	2	18	03	15.511	152.550	28	01 14.12
3	16	04	23.070	148.635	23	49 23.70	3	18	05	48.061	152.461	28	02 23.04
4	16	06	51.705	148.849	23	58 38.22	4	18	08	20.522	152.364	28	03 21.38
5	16	09	20.554	149.060	24	07 43.28	5	18	10	52.886	152.259	28	04 09.15
6	16	11	49.614	149.265	24	16 38.80	6	18	13	25.145	152.147	28	04 46.38
7	16	14	18.879	149.468	24	25 24.74	7	18	15	57.292	152.027	28	05 13.07
8	16	16	48.347	149.666	24	34 01.02	8	18	18	29.319	151.899	28	05 29.26
9	16	19	18.013	149.859	24	42 27.60	9	18	21	01.218	151.762	28	05 34.97
10	16	21	47.872	150.050	24	50 44.42	10	18	23	32.980	151.620	28	05 30.23
11	16	24	17.922	150.234	24	58 51.43	11	18	26	04.600	151.469	28	05 15.06
12	16	26	48.156	150.415	25	06 48.56	12	18	28	36.069	151.310	28	04 49.51
13	16	29	18.571	150.589	25	14 35.79	13	18	31	07.379	151.144	28	04 13.59
14	16	31	49.160	150.761	25	22 13.04	14	18	33	38.523	150.971	28	03 27.34
15	16	34	19.921	150.925	25	29 40.28	15	18	36	09.494	150.790	28	02 30.81
16	16	36	50.846	151.085	25	36 57.46	16	18	38	40.284	150.602	28	01 24.01
17	16	39	21.931	151.239	25	44 04.53	17	18	41	10.886	150.407	28	00 07.00
18	16	41	53.170	151.388	25	51 01.46	18	18	43	41.293	150.204	27	58 39.82
19	16	44	24.558	151.532	25	57 48.19	19	18	46	11.497	149.996	27	57 02.50
20	16	46	56.090	151.668	26	04 24.69	20	18	48	41.493	149.779	27	55 15.08
21	16	49	27.758	151.799	26	10 50.93	21	18	51	11.272	149.557	27	53 17.62
22	16	51	59.557	151.925	26	17 06.86	22	18	53	40.829	149.327	27	51 10.15
23	16	54	31.482	152.043	-26	23 12.45	23	18	56	10.156	149.091	-27	48 52.72
						-355.21							+147.33
September 11							September 13						
0	16	57	03.525	152.156	-26	29 07.66	0	18	58	39.247	148.848	-27	46 25.39
1	16	59	35.681	152.261	26	34 52.47	1	19	01	08.095	148.599	27	43 48.20
2	17	02	07.942	152.361	26	40 26.84	2	19	03	36.694	148.344	27	41 01.20
3	17	04	40.303	152.454	26	45 50.75	3	19	06	05.038	148.082	27	38 04.45
4	17	07	12.757	152.539	26	51 04.17	4	19	08	33.120	147.815	27	34 58.00
5	17	09	45.296	152.619	26	56 07.07	5	19	11	00.935	147.542	27	31 41.90
6	17	12	17.915	152.690	27	00 59.44	6	19	13	28.477	147.263	27	28 16.21
7	17	14	50.605	152.755	27	05 41.25	7	19	15	55.740	146.979	27	24 40.98
8	17	17	23.360	152.813	27	10 12.47	8	19	18	22.719	146.688	27	20 56.29
9	17	19	56.173	152.863	27	14 33.10	9	19	20	49.407	146.393	27	17 02.17
10	17	22	29.036	152.906	27	18 43.12	10	19	23	15.800	146.092	27	12 58.70
11	17	25	01.942	152.941	27	22 42.51	11	19	25	41.892	145.787	27	08 45.94
12	17	27	34.883	152.970	27	26 31.26	12	19	28	07.679	145.476	27	04 23.94
13	17	30	07.853	152.990	27	30 09.36	13	19	30	33.155	145.161	26	59 52.78
14	17	32	40.843	153.003	27	33 36.80	14	19	32	58.316	144.841	26	55 12.51
15	17	35	13.846	153.008	27	36 53.58	15	19	35	23.157	144.516	26	50 23.20
16	17	37	46.854	153.006	27	39 59.69	16	19	37	47.673	144.187	26	45 24.93
17	17	40	19.860	152.996	27	42 55.12	17	19	40	11.860	143.855	26	40 17.74
18	17	42	52.856	152.977	27	45 39.88	18	19	42	35.715	143.517	26	35 01.72
19	17	45	25.833	152.952	27	48 13.97	19	19	44	59.232	143.177	26	29 36.93
20	17	47	58.785	152.918	27	50 37.38	20	19	47	22.409	142.832	26	24 03.45
21	17	50	31.703	152.876	27	52 50.13	21	19	49	45.241	142.484	26	18 21.33
22	17	53	04.579	152.827	27	54 52.21	22	19	52	07.725	142.131	26	12 30.65
23	17	55	37.406	152.770	27	56 43.64	23	19	54	29.856	141.777	26	06 31.49
24	17	58	10.176		-27	58 24.43	24	19	56	51.633		-26	00 23.91

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 14			September 16		
h	h m s	° ' " 1967	h	h m s	° ' " 1967
0	19 56 51.633	-26 00 23.91	0	21 42 50.451	-18 46 20.24
1	19 59 13.052	25 54 07.98	1	21 44 53.679	18 34 54.36
2	20 01 34.109	25 47 43.79	2	21 46 56.556	18 23 23.89
3	20 03 54.803	25 41 11.41	3	21 48 59.082	18 11 48.92
4	20 06 15.130	25 34 30.90	4	21 51 01.260	18 00 09.53
5	20 08 35.088	25 27 42.34	5	21 53 03.095	17 48 25.77
6	20 10 54.674	25 20 45.81	6	21 55 04.587	17 36 37.73
7	20 13 13.886	25 13 41.39	7	21 57 05.741	17 24 45.47
8	20 15 32.722	25 06 29.15	8	21 59 06.558	17 12 49.08
9	20 17 51.181	24 59 09.16	9	22 01 07.042	17 00 48.61
10	20 20 09.260	24 51 41.50	10	22 03 07.196	16 48 44.14
11	20 22 26.957	24 44 06.26	11	22 05 07.023	16 36 35.74
12	20 24 44.272	24 36 23.50	12	22 07 06.525	16 24 23.49
13	20 27 01.202	24 28 33.31	13	22 09 05.707	16 12 07.44
14	20 29 17.747	24 20 35.76	14	22 11 04.571	15 59 47.67
15	20 31 33.905	24 12 30.92	15	22 13 03.120	15 47 24.25
16	20 33 49.676	24 04 18.89	16	22 15 01.358	15 34 57.25
17	20 36 05.059	23 55 59.74	17	22 16 59.288	15 22 26.73
18	20 38 20.052	23 47 33.53	18	22 18 56.913	15 09 52.77
19	20 40 34.656	23 39 00.37	19	22 20 54.237	14 57 15.42
20	20 42 48.870	23 30 20.31	20	22 22 51.264	14 44 34.76
21	20 45 02.693	23 21 33.44	21	22 24 47.995	14 31 50.86
22	20 47 16.126	23 12 39.85	22	22 26 44.436	14 19 03.78
23	20 49 29.168	-23 03 39.60	23	22 28 40.590	-14 06 13.58
		+546.82			+773.25
September 15			September 17		
h	h m s	° ' " 1967	h	h m s	° ' " 1967
0	20 51 41.820	-22 54 32.78	0	22 30 36.459	-13 53 20.33
1	20 53 54.082	22 45 19.46	1	22 32 32.048	13 40 24.10
2	20 56 05.953	22 35 59.73	2	22 34 27.361	13 27 24.95
3	20 58 17.435	22 26 33.66	3	22 36 22.400	13 14 22.95
4	21 00 28.528	22 17 01.34	4	22 38 17.170	13 01 18.15
5	21 02 39.233	22 07 22.83	5	22 40 11.675	12 48 10.63
6	21 04 49.550	21 57 38.22	6	22 42 05.917	12 35 00.44
7	21 06 59.480	21 47 47.59	7	22 43 59.901	12 21 47.65
8	21 09 09.025	21 37 51.01	8	22 45 53.630	12 08 32.32
9	21 11 18.185	21 27 48.57	9	22 47 47.109	11 55 14.52
10	21 13 26.961	21 17 40.33	10	22 49 40.341	11 41 54.29
11	21 15 35.355	21 07 26.39	11	22 51 33.329	11 28 31.72
12	21 17 43.369	20 57 06.81	12	22 53 26.078	11 15 06.84
13	21 19 51.003	20 46 41.67	13	22 55 18.592	11 01 39.74
14	21 21 58.259	20 36 11.05	14	22 57 10.874	10 48 10.46
15	21 24 05.139	20 25 35.03	15	22 59 02.928	10 34 39.07
16	21 26 11.645	20 14 53.69	16	23 00 54.759	10 21 05.63
17	21 28 17.778	20 04 07.09	17	23 02 46.369	10 07 30.19
18	21 30 23.541	19 53 15.32	18	23 04 37.763	9 53 52.81
19	21 32 28.935	19 42 18.45	19	23 06 28.946	9 40 13.55
20	21 34 33.962	19 31 16.55	20	23 08 19.920	9 26 32.48
21	21 36 38.625	19 20 09.71	21	23 10 10.689	9 12 49.64
22	21 38 42.926	19 08 58.00	22	23 12 01.259	8 59 05.10
23	21 40 46.867	18 57 41.48	23	23 13 51.632	8 45 18.91
24	21 42 50.451	-18 46 20.24	24	23 15 41.812	-8 31 31.13
		+681.24			+827.78

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
September 18									September 20										
h	h	m	s	s	°	'	''	'''	h	h	m	s	s	°	'	''	'''		
0	23	15	41.812	109.992	-	8	31	31.13	+829.32	0	04	22.916	105.670	+	2	44	36.99	+842.20	
1	23	17	31.804	109.808		8	17	41.81	830.80	1	04	08.586	105.678		2	58	39.19	841.29	
2	23	19	21.612	109.628		8	03	51.01	832.22	2	04	54.264	105.690		3	12	40.48	840.34	
3	23	21	11.240	109.451		7	49	58.79	833.59	3	04	39.954	105.705		3	26	40.82	839.33	
4	23	23	00.691	109.278		7	36	05.20	834.90	4	04	25.659	105.724		3	40	40.15	838.28	
5	23	24	49.969	109.110		7	22	10.30	836.16	5	05	11.383	105.748		3	54	38.43	837.18	
6	23	26	39.079	108.946		7	08	14.14	837.37	6	05	57.131	105.775		4	08	35.61	836.05	
7	23	28	28.025	108.785		6	54	16.77	838.51	7	05	42.906	105.806		4	22	31.66	834.86	
8	23	30	16.810	108.629		6	40	18.26	839.61	8	05	55.28.712	105.841		4	36	26.52	833.64	
9	23	32	05.439	108.477		6	26	18.65	840.66	9	05	14.553	105.880		4	50	20.16	832.35	
10	23	33	53.916	108.328		6	12	17.99	841.65	10	05	00.433	105.923		5	04	12.51	831.04	
11	23	35	42.244	108.184		5	58	16.34	842.58	11	10	04.6.356	105.969		5	18	03.55	829.67	
12	23	37	30.428	108.044		5	44	13.76	843.46	12	10	02.32.325	106.020		5	31	53.22	828.26	
13	23	39	18.472	107.907		5	30	10.30	844.30	13	10	04.18.345	106.074		5	45	41.48	826.80	
14	23	41	06.379	107.776		5	16	06.00	845.08	14	10	06.04.419	106.132		5	59	28.28	825.31	
15	23	42	54.155	107.647		5	02	00.92	845.81	15	10	07.50.551	106.194		6	13	13.59	823.75	
16	23	44	41.802	107.523		4	47	55.11	846.48	16	10	09.36.745	106.260		6	26	57.34	822.17	
17	23	46	29.325	107.403		4	33	48.63	847.11	17	11	11.23.005	106.329		6	40	39.51	820.53	
18	23	48	16.728	107.287		4	19	41.52	847.68	18	11	13.09.334	106.403		6	54	20.04	818.84	
19	23	50	04.015	107.175		4	05	33.84	848.21	19	11	14.55.737	106.480		7	07	58.88	817.13	
20	23	51	51.190	107.066		3	51	25.63	848.68	20	11	16.42.217	106.561		7	21	36.01	815.35	
21	23	53	38.256	106.963		3	37	16.95	849.10	21	11	18.28.778	106.646		7	35	11.36	813.53	
22	23	55	25.219	106.863		3	23	07.85	849.47	22	11	20.15.424	106.734		7	48	44.89	811.67	
23	23	57	12.082	106.767	-	3	08	58.38	+849.79	23	11	22.02.158	106.826	+	8	02	16.56	+809.77	
September 19									September 21										
0	23	58	58.849	106.676	-	2	54	48.59	+850.07	0	1	23	48.984	106.923	+	8	15	46.33	+807.81
1	00	00	45.525	106.587		2	40	38.52	850.29	1	1	25	35.907	107.022		8	29	14.14	805.82
2	00	02	32.112	106.503		2	26	28.23	850.47	2	1	27	22.929	107.126		8	42	39.96	803.77
3	00	04	18.615	106.424		2	12	17.76	850.59	3	1	29	10.055	107.233		8	56	03.73	801.69
4	00	06	05.039	106.348		1	58	07.17	850.66	4	1	30	57.288	107.343		9	09	25.42	799.56
5	00	07	51.387	106.276		1	43	56.51	850.70	5	1	32	44.631	107.459		9	22	44.98	797.37
6	00	09	37.663	106.209		1	29	45.81	850.67	6	1	34	32.090	107.576		9	36	02.35	795.16
7	00	11	23.872	106.144		1	15	35.14	850.60	7	1	36	19.666	107.699		9	49	17.51	792.88
8	00	13	10.016	106.085		1	01	24.54	850.49	8	1	38	07.365	107.824		10	02	30.39	790.57
9	00	14	56.101	106.029		0	47	14.05	850.32	9	1	39	55.189	107.954		10	15	40.96	788.21
10	00	16	42.130	105.978		0	33	03.73	850.11	10	1	41	43.143	108.086		10	28	49.17	785.81
11	00	18	28.108	105.929		0	18	53.62	849.85	11	1	43	31.229	108.223		10	41	54.98	783.35
12	00	20	14.037	105.886	-	0	04	43.77	849.54	12	1	45	19.452	108.363		10	54	58.33	780.86
13	00	21	59.923	105.846	+	0	09	25.77	849.18	13	1	47	07.815	108.506		11	07	59.19	778.32
14	00	23	45.769	105.810		0	23	34.95	848.79	14	1	48	56.321	108.654		11	20	57.51	775.72
15	00	25	31.579	105.779		0	37	43.74	848.33	15	1	50	44.975	108.804		11	33	53.23	773.09
16	00	27	17.358	105.751		0	51	52.07	847.84	16	1	52	33.779	108.959		11	46	46.32	770.41
17	00	29	03.109	105.726		1	05	59.91	847.30	17	1	54	22.738	109.117		11	59	36.73	767.68
18	00	30	48.835	105.707		1	20	07.21	846.70	18	1	56	11.855	109.278		12	12	24.41	764.91
19	00	32	34.542	105.691		1	34	13.91	846.07	19	1	58	01.133	109.443		12	25	09.32	762.08
20	00	34	20.233	105.679		1	48	19.98	845.39	20	1	59	50.576	109.611		12	37	51.40	759.22
21	00	36	05.912	105.671		2	02	25.37	844.67	21	2	01	40.187	109.783		12	50	30.62	756.31
22	00	37	51.583	105.667		2	16	30.04	843.88	22	2	03	29.970	109.959		13	03	06.93	753.34
23	00	39	37.250	105.666		2	30	33.92	+843.07	23	2	05	19.929	110.137		13	15	40.27	+750.34
24	00	41	22.916		+	2	44	36.99		24	2	07	10.066		+	13	28	10.61	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 22			September 24		
0	2 07 10.066 ^s	+13 28 10.61 ["]	0	3 39 46.690 ^s	+22 13 26.07 ["]
1	2 09 00.385 ^s	13 40 37.89 ["]	1	3 41 49.136 ^s	22 22 27.88 ["]
2	2 10 50.889 ^s	13 53 02.06 ["]	2	3 43 51.887 ^s	22 31 24.11 ["]
3	2 12 41.582 ^s	14 05 23.09 ["]	3	3 45 54.945 ^s	22 40 14.71 ["]
4	2 14 32.467 ^s	14 17 40.92 ["]	4	3 47 58.311 ^s	22 48 59.61 ["]
5	2 16 23.548 ^s	14 29 55.50 ["]	5	3 50 01.986 ^s	22 57 38.77 ["]
6	2 18 14.827 ^s	14 42 06.79 ["]	6	3 52 05.970 ^s	23 06 12.12 ["]
7	2 20 06.308 ^s	14 54 14.74 ["]	7	3 54 10.266 ^s	23 14 39.61 ["]
8	2 21 57.994 ^s	15 06 19.30 ["]	8	3 56 14.873 ^s	23 23 01.18 ["]
9	2 23 49.888 ^s	15 18 20.42 ["]	9	3 58 19.793 ^s	23 31 16.79 ["]
10	2 25 41.994 ^s	15 30 18.05 ["]	10	4 00 25.026 ^s	23 39 26.36 ["]
11	2 27 34.315 ^s	15 42 12.15 ["]	11	4 02 30.572 ^s	23 47 29.85 ["]
12	2 29 26.854 ^s	15 54 02.66 ["]	12	4 04 36.432 ^s	23 55 27.19 ["]
13	2 31 19.613 ^s	16 05 49.54 ["]	13	4 06 42.607 ^s	24 03 18.34 ["]
14	2 33 12.596 ^s	16 17 32.74 ["]	14	4 08 49.097 ^s	24 11 03.22 ["]
15	2 35 05.807 ^s	16 29 12.20 ["]	15	4 10 55.901 ^s	24 18 41.80 ["]
16	2 36 59.247 ^s	16 40 47.89 ["]	16	4 13 03.021 ^s	24 26 14.01 ["]
17	2 38 52.920 ^s	16 52 19.74 ["]	17	4 15 10.456 ^s	24 33 39.79 ["]
18	2 40 46.829 ^s	17 03 47.71 ["]	18	4 17 18.206 ^s	24 40 59.09 ["]
19	2 42 40.977 ^s	17 15 11.74 ["]	19	4 19 26.271 ^s	24 48 11.85 ["]
20	2 44 35.367 ^s	17 26 31.80 ["]	20	4 21 34.650 ^s	24 55 18.01 ["]
21	2 46 30.001 ^s	17 37 47.82 ["]	21	4 23 43.344 ^s	25 02 17.52 ["]
22	2 48 24.882 ^s	17 48 59.76 ["]	22	4 25 52.352 ^s	25 09 10.32 ["]
23	2 50 20.014 ^s	+18 00 07.56 ["]	23	4 28 01.673 ^s	+25 15 56.35 ["]
	115.384	+663.62		129.634	+399.21
September 23			September 25		
0	2 52 15.398 ^s	+18 11 11.18 ["]	0	4 30 11.307 ^s	+25 22 35.56 ["]
1	2 54 11.037 ^s	18 22 10.56 ["]	1	4 32 21.253 ^s	25 29 07.89 ["]
2	2 56 06.935 ^s	18 33 05.66 ["]	2	4 34 31.510 ^s	25 35 33.28 ["]
3	2 58 03.093 ^s	18 43 56.41 ["]	3	4 36 42.078 ^s	25 41 51.69 ["]
4	2 59 59.514 ^s	18 54 42.77 ["]	4	4 38 52.954 ^s	25 48 03.04 ["]
5	3 01 56.201 ^s	19 05 24.69 ["]	5	4 41 04.139 ^s	25 54 07.29 ["]
6	3 03 53.157 ^s	19 16 02.11 ["]	6	4 43 15.631 ^s	26 00 04.39 ["]
7	3 05 50.382 ^s	19 26 34.98 ["]	7	4 45 27.428 ^s	26 05 54.26 ["]
8	3 07 47.881 ^s	19 37 03.25 ["]	8	4 47 39.529 ^s	26 11 36.87 ["]
9	3 09 45.655 ^s	19 47 26.87 ["]	9	4 49 51.933 ^s	26 17 12.15 ["]
10	3 11 43.706 ^s	19 57 45.77 ["]	10	4 52 04.637 ^s	26 22 40.05 ["]
11	3 13 42.037 ^s	20 07 59.92 ["]	11	4 54 17.641 ^s	26 28 00.52 ["]
12	3 15 40.650 ^s	20 18 09.26 ["]	12	4 56 30.942 ^s	26 33 13.50 ["]
13	3 17 39.547 ^s	20 28 13.72 ["]	13	4 58 44.539 ^s	26 38 18.93 ["]
14	3 19 38.729 ^s	20 38 13.27 ["]	14	5 00 58.428 ^s	26 43 16.77 ["]
15	3 21 38.200 ^s	20 48 07.84 ["]	15	5 03 12.609 ^s	26 48 06.96 ["]
16	3 23 37.960 ^s	20 57 57.38 ["]	16	5 05 27.079 ^s	26 52 49.44 ["]
17	3 25 38.013 ^s	21 07 41.83 ["]	17	5 07 41.835 ^s	26 57 24.16 ["]
18	3 27 38.358 ^s	21 17 21.15 ["]	18	5 09 56.875 ^s	27 01 51.08 ["]
19	3 29 38.999 ^s	21 26 55.27 ["]	19	5 12 12.196 ^s	27 06 10.13 ["]
20	3 31 39.937 ^s	21 36 24.15 ["]	20	5 14 27.796 ^s	27 10 21.27 ["]
21	3 33 41.174 ^s	21 45 47.72 ["]	21	5 16 43.671 ^s	27 14 24.45 ["]
22	3 35 42.711 ^s	21 55 05.94 ["]	22	5 18 59.820 ^s	27 18 19.61 ["]
23	3 37 44.549 ^s	22 04 18.74 ["]	23	5 21 16.238 ^s	27 22 06.71 ["]
24	3 39 46.690 ^s	+22 13 26.07 ["]	24	5 23 32.924 ^s	+27 25 45.69 ["]
	122.141	+547.33		136.686	+218.98

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
September 26			September 28		
h	h m s	° ' "	h	h m s	° ' "
0	5 23 32.924 ^s	+27 25 45.69 ["]	0	7 16 44.829 ^s	+27 28 26.63 ["]
1	5 25 49.873 ^s	27 29 16.50 ["]	1	7 19 09.084 ^s	27 24 42.11 ["]
2	5 28 07.082 ^s	27 32 39.10 ["]	2	7 21 33.361 ^s	27 20 48.01 ["]
3	5 30 24.548 ^s	27 35 53.44 ["]	3	7 23 57.653 ^s	27 16 44.33 ["]
4	5 32 42.267 ^s	27 38 59.47 ["]	4	7 26 21.956 ^s	27 12 31.06 ["]
5	5 35 00.236 ^s	27 41 57.15 ["]	5	7 28 46.264 ^s	27 08 08.22 ["]
6	5 37 18.451 ^s	27 44 46.42 ["]	6	7 31 10.572 ^s	27 03 35.79 ["]
7	5 39 36.908 ^s	27 47 27.24 ["]	7	7 33 34.875 ^s	26 58 53.79 ["]
8	5 41 55.604 ^s	27 49 59.56 ["]	8	7 35 59.166 ^s	26 54 02.22 ["]
9	5 44 14.534 ^s	27 52 23.35 ["]	9	7 38 23.441 ^s	26 49 01.08 ["]
10	5 46 33.694 ^s	27 54 38.55 ["]	10	7 40 47.696 ^s	26 43 50.39 ["]
11	5 48 53.080 ^s	27 56 45.13 ["]	11	7 43 11.924 ^s	26 38 30.14 ["]
12	5 51 12.688 ^s	27 58 43.04 ["]	12	7 45 36.120 ^s	26 33 00.36 ["]
13	5 53 32.514 ^s	28 00 32.24 ["]	13	7 48 00.281 ^s	26 27 21.05 ["]
14	5 55 52.552 ^s	28 02 12.68 ["]	14	7 50 24.400 ^s	26 21 32.22 ["]
15	5 58 12.799 ^s	28 03 44.34 ["]	15	7 52 48.473 ^s	26 15 33.89 ["]
16	6 00 33.250 ^s	28 05 07.16 ["]	16	7 55 12.496 ^s	26 09 26.07 ["]
17	6 02 53.901 ^s	28 06 21.11 ["]	17	7 57 36.463 ^s	26 03 08.77 ["]
18	6 05 14.746 ^s	28 07 26.16 ["]	18	8 00 00.371 ^s	25 56 42.03 ["]
19	6 07 35.780 ^s	28 08 22.26 ["]	19	8 02 24.214 ^s	25 50 05.85 ["]
20	6 09 57.000 ^s	28 09 09.37 ["]	20	8 04 47.987 ^s	25 43 20.25 ["]
21	6 12 18.399 ^s	28 09 47.48 ["]	21	8 07 11.688 ^s	25 36 25.27 ["]
22	6 14 39.974 ^s	28 10 16.53 ["]	22	8 09 35.311 ^s	25 29 20.90 ["]
23	6 17 01.718 ^s	+28 10 36.49 ["]	23	8 11 58.853 ^s	+25 22 07.20 ["]
September 27			September 29		
0	6 19 23.628 ^s	+28 10 47.34 ["]	0	8 14 22.309 ^s	+25 14 44.17 ["]
1	6 21 45.696 ^s	28 10 49.05 ["]	1	8 16 45.675 ^s	25 07 11.84 ["]
2	6 24 07.920 ^s	28 10 41.57 ["]	2	8 19 08.948 ^s	24 59 30.25 ["]
3	6 26 30.292 ^s	28 10 24.89 ["]	3	8 21 32.123 ^s	24 51 39.41 ["]
4	6 28 52.808 ^s	28 09 58.97 ["]	4	8 23 55.197 ^s	24 43 39.37 ["]
5	6 31 15.462 ^s	28 09 23.78 ["]	5	8 26 18.167 ^s	24 35 30.15 ["]
6	6 33 38.250 ^s	28 08 39.31 ["]	6	8 28 41.029 ^s	24 27 11.79 ["]
7	6 36 01.164 ^s	28 07 45.52 ["]	7	8 31 03.779 ^s	24 18 44.31 ["]
8	6 38 24.201 ^s	28 06 42.39 ["]	8	8 33 26.415 ^s	24 10 07.76 ["]
9	6 40 47.355 ^s	28 05 29.89 ["]	9	8 35 48.933 ^s	24 01 22.16 ["]
10	6 43 10.619 ^s	28 04 08.01 ["]	10	8 38 11.331 ^s	23 52 27.57 ["]
11	6 45 33.989 ^s	28 02 36.73 ["]	11	8 40 33.604 ^s	23 43 24.01 ["]
12	6 47 57.458 ^s	28 00 56.02 ["]	12	8 42 55.752 ^s	23 34 11.53 ["]
13	6 50 21.022 ^s	27 59 05.86 ["]	13	8 45 17.770 ^s	23 24 50.16 ["]
14	6 52 44.674 ^s	27 57 06.25 ["]	14	8 47 39.657 ^s	23 15 19.96 ["]
15	6 55 08.409 ^s	27 54 57.15 ["]	15	8 50 01.409 ^s	23 05 40.95 ["]
16	6 57 32.222 ^s	27 52 38.56 ["]	16	8 52 23.025 ^s	22 55 53.20 ["]
17	6 59 56.106 ^s	27 50 10.46 ["]	17	8 54 44.502 ^s	22 45 56.74 ["]
18	7 02 20.056 ^s	27 47 32.85 ["]	18	8 57 05.838 ^s	22 35 51.62 ["]
19	7 04 44.067 ^s	27 44 45.70 ["]	19	8 59 27.032 ^s	22 25 37.88 ["]
20	7 07 08.132 ^s	27 41 49.00 ["]	20	9 01 48.080 ^s	22 15 15.59 ["]
21	7 09 32.246 ^s	27 38 42.76 ["]	21	9 04 08.983 ^s	22 04 44.78 ["]
22	7 11 56.404 ^s	27 35 26.95 ["]	22	9 06 29.737 ^s	21 54 05.51 ["]
23	7 14 20.600 ^s	27 32 01.58 ["]	23	9 08 50.342 ^s	21 43 17.83 ["]
24	7 16 44.829 ^s	+27 28 26.63 ["]	24	9 11 10.796 ^s	+21 32 21.80 ["]

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination					
September 30									October 2										
h	h	m	s	°	'	"	°	'	"	h	h	m	s	°	'	"	°	'	"
0	9	11	10.796	140°302	+21	32 21.80	-664.33			0	11	00 36.137	133°666	+10	25 33.04	-978.89			
1	9	13	31.098	140°148	21	21 17.47	672.58			1	11	02 49.803	133°581	10	09 14.15	983.34			
2	9	15	51.246	139°994	21	10 04.89	680.76			2	11	05 03.384	133°499	9	52 50.81	987.68			
3	9	18	11.240	139°838	20	58 44.13	688.90			3	11	07 16.883	133°422	9	36 23.13	991.92			
4	9	20	31.078	139°682	20	47 15.23	696.96			4	11	09 30.305	133°348	9	19 51.21	996.05			
5	9	22	50.760	139°526	20	35 38.27	704.97			5	11	11 43.653	133°277	9	03 15.16	1000.09			
6	9	25	10.286	139°368	20	23 53.30	712.92			6	11	13 56.930	133°211	8	46 35.07	1004.02			
7	9	27	29.654	139°210	20	12 00.38	720.81			7	11	16 10.141	133°149	8	29 51.05	1007.85			
8	9	29	48.864	139°052	19	59 59.57	728.63			8	11	18 23.290	133°089	8	13 03.20	1011.58			
9	9	32	07.916	138°894	19	47 50.94	736.40			9	11	20 36.379	133°034	7	56 11.62	1015.20			
10	9	34	26.810	138°735	19	35 34.54	744.08			10	11	22 49.413	132°983	7	39 16.42	1018.71			
11	9	36	45.545	138°577	19	23 10.46	751.72			11	11	25 02.396	132°936	7	22 17.71	1022.12			
12	9	39	04.122	138°418	19	10 38.74	759.27			12	11	27 15.332	132°893	7	05 15.59	1025.43			
13	9	41	22.540	138°260	18	57 59.47	766.77			13	11	29 28.225	132°855	6	48 10.16	1028.61			
14	9	43	40.800	138°103	18	45 12.70	774.19			14	11	31 41.080	132°819	6	31 01.55	1031.71			
15	9	45	58.903	137°945	18	32 18.51	781.54			15	11	33 53.899	132°788	6	13 49.84	1034.68			
16	9	48	16.848	137°788	18	19 16.97	788.83			16	11	36 06.687	132°763	5	56 35.16	1037.55			
17	9	50	34.636	137°632	18	06 08.14	796.04			17	11	38 19.450	132°740	5	39 17.61	1040.31			
18	9	52	52.268	137°477	17	52 52.10	803.17			18	11	40 32.190	132°722	5	21 57.30	1042.95			
19	9	55	09.745	137°323	17	39 28.93	810.24			19	11	42 44.912	132°708	5	04 34.35	1045.49			
20	9	57	27.068	137°169	17	25 58.69	817.22			20	11	44 57.620	132°699	4	47 08.86	1047.92			
21	9	59	44.237	137°017	17	12 21.47	824.14			21	11	47 10.319	132°695	4	29 40.94	1050.22			
22	10	02	01.254	136°866	16	58 37.33	830.97			22	11	49 23.014	132°694	4	12 10.72	1052.43			
23	10	04	18.120	136°716	+16	44 46.36	-837.73			23	11	51 35.708	132°698	+3	54 38.29	-1054.51			
October 1									October 3										
0	10	06	34.836	136°568	+16	30 48.63	-844.41			0	11	53 48.406	132°706	+3	37 03.78	-1056.48			
1	10	08	51.404	136°421	16	16 44.22	851.01			1	11	56 01.112	132°720	3	19 27.30	1058.33			
2	10	11	07.825	136°275	16	02 33.21	857.53			2	11	58 13.832	132°736	3	01 48.97	1060.08			
3	10	13	24.100	136°132	15	48 15.68	863.97			3	12	00 26.568	132°759	2	44 08.89	1061.70			
4	10	15	40.232	135°991	15	33 51.71	870.32			4	12	02 39.327	132°786	2	26 27.19	1063.20			
5	10	17	56.223	135°850	15	19 21.39	876.60			5	12	04 52.113	132°817	2	08 43.99	1064.60			
6	10	20	12.073	135°713	15	04 44.79	882.79			6	12	07 04.930	132°852	1	50 59.39	1065.88			
7	10	22	27.786	135°576	14	50 02.00	888.89			7	12	09 17.782	132°893	1	33 13.51	1067.03			
8	10	24	43.362	135°443	14	35 13.11	894.91			8	12	11 30.675	132°938	1	15 26.48	1068.06			
9	10	26	58.805	135°312	14	20 18.20	900.84			9	12	13 43.613	132°988	0	57 38.42	1068.99			
10	10	29	14.117	135°183	14	05 17.36	906.68			10	12	15 56.601	133°042	0	39 49.43	1069.78			
11	10	31	29.300	135°056	13	50 10.68	912.45			11	12	18 09.643	133°101	0	21 59.65	1070.46			
12	10	33	44.356	134°931	13	34 58.23	918.11			12	12	20 22.744	133°165	+0	04 09.19	1071.03			
13	10	35	59.287	134°811	13	19 40.12	923.69			13	12	22 35.909	133°233	-0	13 41.84	1071.46			
14	10	38	14.098	134°691	13	04 16.43	929.18			14	12	24 49.142	133°306	0	31 33.30	1071.78			
15	10	40	28.789	134°575	12	48 47.25	934.57			15	12	27 02.448	133°384	0	49 25.08	1071.97			
16	10	42	43.364	134°462	12	33 12.68	939.88			16	12	29 15.832	133°466	1	07 17.05	1072.05			
17	10	44	57.826	134°351	12	17 32.80	945.09			17	12	31 29.298	133°553	1	25 09.10	1072.01			
18	10	47	12.177	134°244	12	01 47.71	950.21			18	12	33 42.851	133°645	1	43 01.11	1071.83			
19	10	49	26.421	134°139	11	45 57.50	955.23			19	12	35 56.496	133°742	2	00 52.94	1071.53			
20	10	51	40.560	134°039	11	30 02.27	960.15			20	12	38 10.238	133°842	2	18 44.47	1071.12			
21	10	53	54.599	133°940	11	14 02.12	964.99			21	12	40 24.080	133°948	2	36 35.59	1070.59			
22	10	56	08.539	133°845	10	57 57.13	969.73			22	12	42 38.028	134°059	2	54 26.18	1069.91			
23	10	58	22.384	133°753	10	41 47.40	-974.36			23	12	44 52.087	134°174	3	12 16.09	-1069.13			
24	11	00	36.137	133°668	+10	25 33.04				24	12	47 06.261	134°299	-3	30 05.22				

MOON, 1967

FOR EACH HOUR OF EPHEMERIS TIME

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Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 4			October 6		
h	h m s	° ' " s	h	h m s	° ' " s
0	12 47 06.261	134.293	0	14 38 03.903	144.624
1	12 49 20.554	134.418	1	14 40 28.527	144.905
2	12 51 34.972	134.546	2	14 42 53.432	145.185
3	12 53 49.518	134.680	3	14 45 18.617	145.468
4	12 56 04.198	134.818	4	14 47 44.085	145.749
5	12 58 19.016	134.960	5	14 50 09.834	146.033
6	13 00 33.976	135.108	6	14 52 35.867	146.315
7	13 02 49.084	135.258	7	14 55 02.182	146.598
8	13 05 04.342	135.415	8	14 57 28.780	146.881
9	13 07 19.757	135.574	9	14 59 55.661	147.164
10	13 09 35.331	135.740	10	15 02 22.825	147.446
11	13 11 51.071	135.908	11	15 04 50.271	147.727
12	13 14 06.979	136.081	12	15 07 17.998	148.009
13	13 16 23.060	136.259	13	15 09 46.007	148.288
14	13 18 39.319	136.440	14	15 12 14.295	148.568
15	13 20 55.759	136.626	15	15 14 42.863	148.845
16	13 23 12.385	136.816	16	15 17 11.708	149.122
17	13 25 29.201	137.010	17	15 19 40.830	149.397
18	13 27 46.211	137.207	18	15 22 10.227	149.669
19	13 30 03.418	137.410	19	15 24 39.896	149.941
20	13 32 20.828	137.615	20	15 27 09.837	150.209
21	13 34 38.443	137.825	21	15 29 40.046	150.476
22	13 36 56.268	138.038	22	15 32 10.522	150.741
23	13 39 14.306	138.255	23	15 34 41.263	151.001
October 5			October 7		
h	h m s	° ' " s	h	h m s	° ' " s
0	13 41 32.561	138.475	0	15 37 12.264	151.261
1	13 43 51.036	138.700	1	15 39 43.525	151.516
2	13 46 09.736	138.927	2	15 42 15.041	151.768
3	13 48 28.663	139.159	3	15 44 46.809	152.018
4	13 50 47.822	139.392	4	15 47 18.827	152.263
5	13 53 07.214	139.630	5	15 49 51.090	152.504
6	13 55 26.844	139.871	6	15 52 23.594	152.742
7	13 57 46.715	140.114	7	15 54 56.336	152.976
8	14 00 06.829	140.361	8	15 57 29.312	153.204
9	14 02 27.190	140.611	9	16 00 02.516	153.430
10	14 04 47.801	140.862	10	16 02 35.946	153.649
11	14 07 08.663	141.118	11	16 05 09.595	153.865
12	14 09 29.781	141.375	12	16 07 43.460	154.075
13	14 11 51.156	141.636	13	16 10 17.535	154.280
14	14 14 12.792	141.897	14	16 12 51.815	154.479
15	14 16 34.689	142.162	15	16 15 26.294	154.673
16	14 18 56.851	142.429	16	16 18 00.967	154.862
17	14 21 19.280	142.698	17	16 20 35.829	155.043
18	14 23 41.978	142.968	18	16 23 10.872	155.220
19	14 26 04.946	143.240	19	16 25 46.092	155.390
20	14 28 28.186	143.515	20	16 28 21.482	155.554
21	14 30 51.701	143.790	21	16 30 57.036	155.711
22	14 33 15.491	144.067	22	16 33 32.747	155.861
23	14 35 39.558	144.345	23	16 36 08.608	156.004
24	14 38 03.903		24	16 38 44.612	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 8			October 10		
^h 0	^h 16 ^m 38 ^s 44.612 ^s 156.141	[°] -25 ['] 49 ["] 45.63 ["] -433.55	^h 0	^h 18 ^m 43 ^s 42.686 ^s 152.909	[°] -28 ['] 05 ["] 56.37 ["] +100.09
1	16 41 20.753 156.271	25 56 59.18 422.57	1	18 46 15.595 152.638	28 04 16.28 110.53
2	16 43 57.024 156.393	26 04 01.75 411.56	2	18 48 48.233 152.358	28 02 25.75 120.91
3	16 46 33.417 156.507	26 10 53.31 400.50	3	18 51 20.591 152.072	28 00 24.84 131.24
4	16 49 09.924 156.615	26 17 33.81 389.41	4	18 53 52.663 151.779	27 58 13.60 141.49
5	16 51 46.539 156.713	26 24 03.22 378.28	5	18 56 24.442 151.480	27 55 52.11 151.70
6	16 54 23.252 156.806	26 30 21.50 367.13	6	18 58 55.922 151.173	27 53 20.41 161.83
7	16 57 00.058 156.889	26 36 28.63 355.94	7	19 01 27.095 150.861	27 50 38.58 171.90
8	16 59 36.947 156.966	26 42 24.57 344.73	8	19 03 57.956 150.542	27 47 46.68 181.91
9	17 02 13.913 157.032	26 48 09.30 333.50	9	19 06 28.498 150.217	27 44 44.77 191.84
10	17 04 50.945 157.093	26 53 42.80 322.24	10	19 08 58.715 149.887	27 41 32.93 201.72
11	17 07 28.038 157.143	26 59 05.04 310.96	11	19 11 28.602 149.550	27 38 11.21 211.51
12	17 10 05.181 157.186	27 04 16.00 299.67	12	19 13 58.152 149.207	27 34 39.70 221.25
13	17 12 42.367 157.220	27 09 15.67 288.35	13	19 16 27.359 148.861	27 30 58.45 230.90
14	17 15 19.587 157.246	27 14 04.02 277.03	14	19 18 56.220 148.507	27 27 07.55 240.49
15	17 17 56.833 157.264	27 18 41.05 265.70	15	19 21 24.727 148.150	27 23 07.06 250.00
16	17 20 34.097 157.271	27 23 06.75 254.36	16	19 23 52.877 147.787	27 18 57.06 259.44
17	17 23 11.368 157.271	27 27 21.11 243.01	17	19 26 20.664 147.419	27 14 37.62 268.81
18	17 25 48.639 157.262	27 31 24.12 231.66	18	19 28 48.083 147.048	27 10 08.81 278.09
19	17 28 25.901 157.244	27 35 15.78 220.30	19	19 31 15.131 146.671	27 05 30.72 287.30
20	17 31 03.145 157.217	27 38 56.08 208.95	20	19 33 41.802 146.291	27 00 43.42 296.44
21	17 33 40.362 157.181	27 42 25.03 197.60	21	19 36 08.093 145.906	26 55 46.98 305.49
22	17 36 17.543 157.137	27 45 42.63 186.25	22	19 38 33.999 145.517	26 50 41.49 314.47
23	17 38 54.680 157.083	-27 48 48.88 -174.92	23	19 40 59.516 145.126	-26 45 27.02 +323.37
October 9			October 11		
0	17 41 31.763 157.020	-27 51 43.80 -163.59	0	19 43 24.642 144.730	-26 40 03.65 +332.19
1	17 44 08.783 156.949	27 54 27.39 152.27	1	19 45 49.372 144.330	26 34 31.46 340.92
2	17 46 45.732 156.868	27 56 59.66 140.97	2	19 48 13.702 143.929	26 28 50.54 349.58
3	17 49 22.600 156.778	27 59 20.63 129.68	3	19 50 37.631 143.523	26 23 00.96 358.16
4	17 51 59.378 156.680	28 01 30.31 118.41	4	19 53 01.154 143.116	26 17 02.80 366.65
5	17 54 36.058 156.573	28 03 28.72 107.16	5	19 55 24.270 142.705	26 10 56.15 375.06
6	17 57 12.631 156.456	28 05 15.88 95.94	6	19 57 46.975 142.292	26 04 41.09 383.40
7	17 59 49.087 156.331	28 06 51.82 84.73	7	20 00 09.267 141.876	25 58 17.69 391.64
8	18 02 25.418 156.197	28 08 16.55 73.56	8	20 02 31.143 141.459	25 51 46.05 399.80
9	18 05 01.615 156.054	28 09 30.11 62.42	9	20 04 52.602 141.040	25 45 06.25 407.89
10	18 07 37.669 155.903	28 10 32.53 51.29	10	20 07 13.642 140.618	25 38 18.36 415.88
11	18 10 13.572 155.743	28 11 23.82 40.21	11	20 09 34.260 140.196	25 31 22.48 423.80
12	18 12 49.315 155.574	28 12 04.03 29.16	12	20 11 54.456 139.771	25 24 18.68 431.63
13	18 15 24.889 155.396	28 12 33.19 18.15	13	20 14 14.227 139.345	25 17 07.05 439.37
14	18 18 00.285 155.211	28 12 51.34 7.17	14	20 16 33.572 138.919	25 09 47.68 447.04
15	18 20 35.496 155.017	28 12 58.51 + 3.76	15	20 18 52.491 138.491	25 02 20.64 454.62
16	18 23 10.513 154.814	28 12 54.75 14.66	16	20 21 10.982 138.062	24 54 46.02 462.11
17	18 25 45.327 154.603	28 12 40.09 25.50	17	20 23 29.044 137.632	24 47 03.91 469.52
18	18 28 19.930 154.386	28 12 14.59 36.32	18	20 25 46.676 137.203	24 39 14.39 476.85
19	18 30 54.316 154.158	28 11 38.27 47.06	19	20 28 03.879 136.772	24 31 17.54 484.09
20	18 33 28.474 153.924	28 10 51.21 57.78	20	20 30 20.651 136.342	24 23 13.45 491.25
21	18 36 02.398 153.682	28 09 53.43 68.43	21	20 32 36.993 135.911	24 15 02.20 498.33
22	18 38 36.080 153.431	28 08 45.00 79.04	22	20 34 52.904 135.481	24 06 43.87 505.32
23	18 41 09.511 153.175	28 07 25.96 89.59	23	20 37 08.385 135.050	23 58 18.55 +512.22
24	18 43 42.686	-28 05 56.37	24	20 39 23.435	-23 49 46.33

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 12			October 14		
h	h m s	° ' "	h	h m s	° ' "
0	20 39 23.435 134.620	-23 49 46.33 +519.05	0	22 19 30.636 116.339	-15 10 37.47 +755.22
1	20 41 38.055 134.190	23 41 07.28 525.79	1	22 21 26.975 116.037	14 58 02.25 758.41
2	20 43 52.245 133.761	23 32 21.49 532.45	2	22 23 23.012 115.738	14 45 23.84 761.54
3	20 46 06.006 133.332	23 23 29.04 539.03	3	22 25 18.750 115.444	14 32 42.30 764.60
4	20 48 19.338 132.905	23 14 30.01 545.52	4	22 27 14.194 115.154	14 19 57.70 767.62
5	20 50 32.243 132.478	23 05 24.49 551.93	5	22 29 09.348 114.867	14 07 10.08 770.56
6	20 52 44.721 132.052	22 56 12.56 558.26	6	22 31 04.215 114.585	13 54 19.52 773.44
7	20 54 56.773 131.628	22 46 54.30 564.50	7	22 32 58.800 114.308	13 41 26.08 776.27
8	20 57 08.401 131.205	22 37 29.80 570.67	8	22 34 53.108 114.033	13 28 29.81 779.03
9	20 59 19.606 130.783	22 27 59.13 576.76	9	22 36 47.141 113.762	13 15 30.78 781.73
10	21 01 30.389 130.362	22 18 22.37 582.76	10	22 38 40.903 113.498	13 02 29.05 784.38
11	21 03 40.751 129.944	22 08 39.61 588.68	11	22 40 34.401 113.235	12 49 24.67 786.97
12	21 05 50.695 129.528	21 58 50.93 594.53	12	22 42 27.636 112.978	12 36 17.70 789.49
13	21 08 00.223 129.112	21 48 56.40 600.29	13	22 44 20.614 112.724	12 23 08.21 791.96
14	21 10 09.335 128.699	21 38 56.11 605.97	14	22 46 13.338 112.475	12 09 56.25 794.37
15	21 12 18.034 128.287	21 28 50.14 611.58	15	22 48 05.813 112.230	11 56 41.88 796.72
16	21 14 26.321 127.879	21 18 38.56 617.11	16	22 49 58.043 111.989	11 43 25.16 799.03
17	21 16 34.200 127.472	21 08 21.45 622.55	17	22 51 50.032 111.752	11 30 06.13 801.26
18	21 18 41.672 127.068	20 57 58.90 627.93	18	22 53 41.784 111.519	11 16 44.87 803.45
19	21 20 48.740 126.665	20 47 30.97 633.22	19	22 55 33.303 111.292	11 03 21.42 805.57
20	21 22 55.405 126.266	20 36 57.75 638.44	20	22 57 24.595 111.067	10 49 55.85 807.65
21	21 25 01.671 125.868	20 26 19.31 643.58	21	22 59 15.662 110.847	10 36 28.20 809.66
22	21 27 07.539 125.474	20 15 35.73 648.64	22	23 01 06.509 110.631	10 22 58.54 811.63
23	21 29 13.013 125.082	-20 04 47.09 +653.63	23	23 02 57.140 110.420	-10 09 26.91 +813.54
October 13			October 15		
0	21 31 18.095 124.693	-19 53 53.46 +658.55	0	23 04 47.560 110.213	-9 55 53.37 +815.39
1	21 33 22.788 124.307	19 42 54.91 663.39	1	23 06 37.773 110.010	9 42 17.98 817.20
2	21 35 27.095 123.924	19 31 51.52 668.15	2	23 08 27.783 109.811	9 28 40.78 818.94
3	21 37 31.019 123.543	19 20 43.37 672.85	3	23 10 17.594 109.616	9 15 01.84 820.63
4	21 39 34.562 123.166	19 09 30.52 677.46	4	23 12 07.210 109.427	9 01 21.21 822.28
5	21 41 37.728 122.792	18 58 13.06 682.01	5	23 13 56.637 109.240	8 47 38.93 823.86
6	21 43 40.520 122.421	18 46 51.05 686.48	6	23 15 45.877 109.058	8 33 55.07 825.40
7	21 45 42.941 122.053	18 35 24.57 690.89	7	23 17 34.935 108.881	8 20 09.67 826.89
8	21 47 44.994 121.688	18 23 53.68 695.22	8	23 19 23.816 108.707	8 06 22.78 828.31
9	21 49 46.682 121.327	18 12 18.46 699.47	9	23 21 12.523 108.538	7 52 34.47 829.70
10	21 51 48.009 120.970	18 00 38.99 703.67	10	23 23 01.061 108.374	7 38 44.77 831.03
11	21 53 48.979 120.614	17 48 55.32 707.79	11	23 24 49.435 108.212	7 24 53.74 832.31
12	21 55 49.593 120.265	17 37 07.53 711.84	12	23 26 37.647 108.056	7 11 01.43 833.54
13	21 57 49.858 119.916	17 25 15.69 715.82	13	23 28 25.703 107.904	6 57 07.89 834.72
14	21 59 49.774 119.573	17 13 19.87 719.73	14	23 30 13.607 107.756	6 43 13.17 835.84
15	22 01 49.347 119.232	17 01 20.14 723.58	15	23 32 01.363 107.612	6 29 17.33 836.92
16	22 03 48.579 118.896	16 49 16.56 727.35	16	23 33 48.975 107.473	6 15 20.41 837.95
17	22 05 47.475 118.563	16 37 09.21 731.07	17	23 35 36.448 107.337	6 01 22.46 838.93
18	22 07 46.038 118.234	16 24 58.14 734.72	18	23 37 23.785 107.207	5 47 23.53 839.86
19	22 09 44.272 117.909	16 12 43.42 738.29	19	23 39 10.992 107.079	5 33 23.67 840.74
20	22 11 42.181 117.586	16 00 25.13 741.81	20	23 40 58.071 106.956	5 19 22.93 841.57
21	22 13 39.767 117.269	15 48 03.32 745.25	21	23 42 45.027 106.838	5 05 21.36 842.35
22	22 15 37.036 116.955	15 35 38.07 748.64	22	23 44 31.865 106.724	4 51 19.01 843.09
23	22 17 33.991 116.645	15 23 09.43 +751.96	23	23 46 18.589 106.613	4 37 15.92 +843.78
24	22 19 30.636	-15 10 37.47	24	23 48 05.202	-4 23 12.14

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 16			October 18		
h	h m s	° ' "	h	h m s	° ' "
0	23 48 05.202	106.508	0	1 12 33.155	106.173
1	23 49 51.710	106.405	1	1 14 19.328	106.261
2	23 51 38.115	106.308	2	1 16 05.589	106.353
3	23 53 24.423	106.215	3	1 17 51.942	106.448
4	23 55 10.638	106.125	4	1 19 38.390	106.548
5	23 56 56.763	106.040	5	1 21 24.938	106.650
6	23 58 42.803	105.959	6	1 23 11.588	106.757
7	0 00 28.762	105.881	7	1 24 58.345	106.866
8	0 02 14.643	105.809	8	1 26 45.211	106.980
9	0 04 00.452	105.741	9	1 28 32.191	107.098
10	0 05 46.193	105.675	10	1 30 19.289	107.218
11	0 07 31.868	105.615	11	1 32 06.507	107.343
12	0 09 17.483	105.559	12	1 33 53.850	107.470
13	0 11 03.042	105.507	13	1 35 41.320	107.601
14	0 12 48.549	105.458	14	1 37 28.921	107.737
15	0 14 34.007	105.413	15	1 39 16.658	107.875
16	0 16 19.420	105.374	16	1 41 04.533	108.016
17	0 18 04.794	105.338	17	1 42 52.549	108.162
18	0 19 50.132	105.305	18	1 44 40.711	108.310
19	0 21 35.437	105.278	19	1 46 29.021	108.463
20	0 23 20.715	105.253	20	1 48 17.484	108.618
21	0 25 05.968	105.234	21	1 50 06.102	108.776
22	0 26 51.202	105.217	22	1 51 54.878	108.939
23	0 28 36.419	105.205	23	1 53 43.817	109.104
October 17			October 19		
0	0 30 21.624	105.198	0	1 55 32.921	109.273
1	0 32 06.822	105.193	1	1 57 22.194	109.444
2	0 33 52.015	105.193	2	1 59 11.638	109.620
3	0 35 37.208	105.197	3	2 01 01.258	109.799
4	0 37 22.405	105.205	4	2 02 51.057	109.980
5	0 39 07.610	105.216	5	2 04 41.037	110.165
6	0 40 52.826	105.232	6	2 06 31.202	110.352
7	0 42 38.058	105.252	7	2 08 21.554	110.544
8	0 44 23.310	105.276	8	2 10 12.098	110.738
9	0 46 08.586	105.302	9	2 12 02.836	110.935
10	0 47 53.888	105.334	10	2 13 53.771	111.135
11	0 49 39.222	105.369	11	2 15 44.906	111.338
12	0 51 24.591	105.408	12	2 17 36.244	111.545
13	0 53 09.999	105.451	13	2 19 27.789	111.754
14	0 54 55.450	105.498	14	2 21 19.543	111.965
15	0 56 40.948	105.548	15	2 23 11.508	112.181
16	0 58 26.496	105.603	16	2 25 03.689	112.398
17	1 00 12.099	105.660	17	2 26 56.087	112.619
18	1 01 57.759	105.723	18	2 28 48.706	112.842
19	1 03 43.482	105.788	19	2 30 41.548	113.068
20	1 05 29.270	105.858	20	2 32 34.616	113.296
21	1 07 15.128	105.931	21	2 34 27.912	113.528
22	1 09 01.059	106.008	22	2 36 21.440	113.762
23	1 10 47.067	106.088	23	2 38 15.202	113.998
24	1 12 33.155	106.111	24	2 40 09.200	114.235

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 20			October 22		
h	h m s	° ' "	h	h m s	° ' "
0	2 40 09.200	+17 01 58.25	0	4 16 36.722	+24 41 24.16
1	2 42 03.437	+17 13 26.14	1	4 18 44.323	+24 48 38.38
2	2 43 57.916	+17 24 50.02	2	4 20 52.214	+24 55 45.97
3	2 45 52.639	+17 36 09.86	3	4 23 00.393	+25 02 46.86
4	2 47 47.608	+17 47 25.59	4	4 25 08.860	+25 09 41.01
5	2 49 42.826	+17 58 37.16	5	4 27 17.613	+25 16 28.36
6	2 51 38.295	+18 09 44.52	6	4 29 26.651	+25 23 08.86
7	2 53 34.017	+18 20 47.61	7	4 31 35.973	+25 29 42.46
8	2 55 29.994	+18 31 46.38	8	4 33 45.577	+25 36 09.10
9	2 57 26.229	+18 42 40.77	9	4 35 55.463	+25 42 28.73
10	2 59 22.724	+18 53 30.74	10	4 38 05.627	+25 48 41.31
11	3 01 19.481	+19 04 16.23	11	4 40 16.070	+25 54 46.77
12	3 03 16.501	+19 14 57.18	12	4 42 26.788	+26 00 45.06
13	3 05 13.787	+19 25 33.53	13	4 44 37.780	+26 06 36.14
14	3 07 11.341	+19 36 05.24	14	4 46 49.044	+26 12 19.96
15	3 09 09.164	+19 46 32.26	15	4 49 00.578	+26 17 56.46
16	3 11 07.259	+19 56 54.51	16	4 51 12.380	+26 23 25.59
17	3 13 05.626	+20 07 11.96	17	4 53 24.447	+26 28 47.31
18	3 15 04.268	+20 17 24.53	18	4 55 36.778	+26 34 01.57
19	3 17 03.187	+20 27 32.19	19	4 57 49.369	+26 39 08.31
20	3 19 02.383	+20 37 34.87	20	5 00 02.218	+26 44 07.49
21	3 21 01.858	+20 47 32.53	21	5 02 15.322	+26 48 59.06
22	3 23 01.614	+20 57 25.09	22	5 04 28.679	+26 53 42.98
23	3 25 01.653	+21 07 12.51	23	5 06 42.285	+26 58 19.19
	120.321	+582.23		133.854	+268.46
October 21			October 23		
0	3 27 01.974	+21 16 54.74	0	5 08 56.139	+27 02 47.65
1	3 29 02.580	+21 26 31.71	1	5 11 10.236	+27 07 08.32
2	3 31 03.472	+21 36 03.37	2	5 13 24.574	+27 11 21.15
3	3 33 04.650	+21 45 29.67	3	5 15 39.150	+27 15 26.09
4	3 35 06.116	+21 54 50.55	4	5 17 53.959	+27 19 23.11
5	3 37 07.871	+22 04 05.95	5	5 20 09.000	+27 23 12.15
6	3 39 09.916	+22 13 15.82	6	5 22 24.267	+27 26 53.18
7	3 41 12.250	+22 22 20.10	7	5 24 39.759	+27 30 26.15
8	3 43 14.876	+22 31 18.74	8	5 26 55.470	+27 33 51.03
9	3 45 17.793	+22 40 11.69	9	5 29 11.398	+27 37 07.76
10	3 47 21.002	+22 48 58.87	10	5 31 27.539	+27 40 16.32
11	3 49 24.504	+22 57 40.25	11	5 33 43.888	+27 43 16.65
12	3 51 28.299	+23 06 15.76	12	5 36 00.441	+27 46 08.73
13	3 53 32.388	+23 14 45.35	13	5 38 17.196	+27 48 52.51
14	3 55 36.770	+23 23 08.96	14	5 40 34.147	+27 51 27.96
15	3 57 41.445	+23 31 26.54	15	5 42 51.290	+27 53 55.04
16	3 59 46.415	+23 39 38.03	16	5 45 08.621	+27 56 13.72
17	4 01 51.678	+23 47 43.38	17	5 47 26.136	+27 58 23.96
18	4 03 57.234	+23 55 42.53	18	5 49 43.830	+28 00 25.72
19	4 06 03.084	+24 03 35.42	19	5 52 01.700	+28 02 18.97
20	4 08 09.228	+24 11 22.01	20	5 54 19.739	+28 04 03.68
21	4 10 15.663	+24 19 02.23	21	5 56 37.944	+28 05 39.82
22	4 12 22.392	+24 26 36.03	22	5 58 56.310	+28 07 07.36
23	4 14 29.411	+24 34 03.36	23	6 01 14.833	+28 08 26.27
24	4 16 36.722	+24 41 24.16	24	6 03 33.507	+28 09 36.51
	127.311	+440.80		138.674	+70.24

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
October 24			October 26		
0	6 03 33.507 ^s 138.821	+28 09 36.51 ^s	0	7 55 49.207 ^s 139.967	+26 10 29.88 ^s
1	6 05 52.328 ^s 138.963	28 10 38.06 ^s + 61.55	1	7 58 09.174 ^s 139.878	26 04 20.23 ^s - 369.65
2	6 08 11.291 ^s 139.099	28 11 30.89 ^s 52.83	2	8 00 29.052 ^s 139.786	25 58 01.72 ^s 378.51
3	6 10 30.390 ^s 139.232	28 12 14.98 ^s 44.09	3	8 02 48.838 ^s 139.691	25 51 34.38 ^s 387.34
4	6 12 49.622 ^s 139.359	28 12 50.30 ^s 35.32	4	8 05 08.529 ^s 139.592	25 44 58.22 ^s 396.16
5	6 15 08.981 ^s 139.482	28 13 16.83 ^s 26.53	5	8 07 28.121 ^s 139.491	25 38 13.28 ^s 404.94
6	6 17 28.463 ^s 139.598	28 13 34.54 ^s + 17.71	6	8 09 47.612 ^s 139.385	25 31 19.56 ^s 413.72
7	6 19 48.061 ^s 139.710	28 13 43.40 ^s + 8.86	7	8 12 06.997 ^s 139.277	25 24 17.11 ^s 422.45
8	6 22 07.771 ^s 139.817	28 13 43.40 ^s 0.00	8	8 14 26.274 ^s 139.166	25 17 05.94 ^s 431.17
9	6 24 27.588 ^s 139.919	28 13 34.52 ^s - 8.88	9	8 16 45.440 ^s 139.052	25 09 46.08 ^s 439.86
10	6 26 47.507 ^s 140.015	28 13 16.74 ^s 17.78	10	8 19 04.492 ^s 138.935	25 02 17.57 ^s 448.51
11	6 29 07.522 ^s 140.106	28 12 50.03 ^s 26.71	11	8 21 23.427 ^s 138.815	24 54 40.43 ^s 457.14
12	6 31 27.628 ^s 140.193	28 12 14.38 ^s 35.65	12	8 23 42.242 ^s 138.694	24 46 54.69 ^s 465.74
13	6 33 47.821 ^s 140.274	28 11 29.77 ^s 44.61	13	8 26 00.936 ^s 138.569	24 39 00.38 ^s 474.31
14	6 36 08.095 ^s 140.349	28 10 36.19 ^s 53.58	14	8 28 19.505 ^s 138.442	24 30 57.53 ^s 482.85
15	6 38 28.444 ^s 140.420	28 09 33.63 ^s 62.56	15	8 30 37.947 ^s 138.313	24 22 46.18 ^s 491.35
16	6 40 48.864 ^s 140.485	28 08 22.06 ^s 71.57	16	8 32 56.260 ^s 138.182	24 14 26.36 ^s 499.82
17	6 43 09.349 ^s 140.546	28 07 01.47 ^s 80.59	17	8 35 14.442 ^s 138.048	24 05 58.11 ^s 508.25
18	6 45 29.895 ^s 140.600	28 05 31.86 ^s 89.61	18	8 37 32.490 ^s 137.914	23 57 21.45 ^s 516.66
19	6 47 50.495 ^s 140.650	28 03 53.21 ^s 98.65	19	8 39 50.404 ^s 137.777	23 48 36.43 ^s 525.02
20	6 50 11.145 ^s 140.695	28 02 05.51 ^s 107.70	20	8 42 08.181 ^s 137.637	23 39 43.09 ^s 533.34
21	6 52 31.840 ^s 140.733	28 00 08.76 ^s 116.75	21	8 44 25.818 ^s 137.498	23 30 41.45 ^s 541.64
22	6 54 52.573 ^s 140.768	27 58 02.94 ^s 125.82	22	8 46 43.316 ^s 137.356	23 21 31.56 ^s 549.89
23	6 57 13.341 ^s 140.797	+27 55 48.06 ^s 134.88	23	8 49 00.672 ^s 137.213	+23 12 13.46 ^s 558.10
		-143.97			-566.28
October 25			October 27		
0	6 59 34.138 ^s 140.821	+27 53 24.09 ^s -153.04	0	8 51 17.885 ^s 137.068	+23 02 47.18 ^s -574.40
1	7 01 54.959 ^s 140.839	27 50 51.05 ^s 162.13	1	8 53 34.953 ^s 136.923	22 53 12.78 ^s 582.50
2	7 04 15.798 ^s 140.853	27 48 08.92 ^s 171.21	2	8 55 51.876 ^s 136.776	22 43 30.28 ^s 590.54
3	7 06 36.651 ^s 140.862	27 45 17.71 ^s 180.30	3	8 58 08.652 ^s 136.629	22 33 39.74 ^s 598.55
4	7 08 57.513 ^s 140.865	27 42 17.41 ^s 189.40	4	9 00 25.281 ^s 136.481	22 23 41.19 ^s 606.51
5	7 11 18.378 ^s 140.864	27 39 08.01 ^s 198.47	5	9 02 41.762 ^s 136.331	22 13 34.68 ^s 614.43
6	7 13 39.242 ^s 140.858	27 35 49.54 ^s 207.57	6	9 04 58.093 ^s 136.182	22 03 20.25 ^s 622.30
7	7 16 00.100 ^s 140.847	27 32 21.97 ^s 216.65	7	9 07 14.275 ^s 136.031	21 52 57.95 ^s 630.12
8	7 18 20.947 ^s 140.830	27 28 45.32 ^s 225.72	8	9 09 30.306 ^s 135.882	21 42 27.83 ^s 637.90
9	7 20 41.777 ^s 140.810	27 24 59.60 ^s 234.81	9	9 11 46.188 ^s 135.730	21 31 49.93 ^s 645.63
10	7 23 02.587 ^s 140.784	27 21 04.79 ^s 243.87	10	9 14 01.918 ^s 135.579	21 21 04.30 ^s 653.31
11	7 25 23.371 ^s 140.755	27 17 00.92 ^s 252.93	11	9 16 17.497 ^s 135.429	21 10 10.99 ^s 660.95
12	7 27 44.126 ^s 140.719	27 12 47.99 ^s 261.99	12	9 18 32.926 ^s 135.277	20 59 10.04 ^s 668.53
13	7 30 04.845 ^s 140.680	27 08 26.00 ^s 271.03	13	9 20 48.203 ^s 135.127	20 48 01.51 ^s 676.06
14	7 32 25.525 ^s 140.636	27 03 54.97 ^s 280.07	14	9 23 03.330 ^s 134.976	20 36 45.45 ^s 683.55
15	7 34 46.161 ^s 140.588	26 59 14.90 ^s 289.09	15	9 25 18.306 ^s 134.826	20 25 21.90 ^s 690.98
16	7 37 06.749 ^s 140.535	26 54 25.81 ^s 298.10	16	9 27 33.132 ^s 134.676	20 13 50.92 ^s 698.35
17	7 39 27.284 ^s 140.478	26 49 27.71 ^s 307.10	17	9 29 47.808 ^s 134.527	20 02 12.57 ^s 705.68
18	7 41 47.762 ^s 140.418	26 44 20.61 ^s 316.09	18	9 32 02.335 ^s 134.378	19 50 26.89 ^s 712.96
19	7 44 08.180 ^s 140.352	26 39 04.52 ^s 325.05	19	9 34 16.713 ^s 134.231	19 38 33.93 ^s 720.17
20	7 46 28.532 ^s 140.282	26 33 39.47 ^s 334.01	20	9 36 30.944 ^s 134.084	19 26 33.76 ^s 727.33
21	7 48 48.814 ^s 140.210	26 28 05.46 ^s 342.95	21	9 38 45.028 ^s 133.938	19 14 26.43 ^s 734.44
22	7 51 09.024 ^s 140.132	26 22 22.51 ^s 351.87	22	9 40 58.966 ^s 133.794	19 02 11.99 ^s 741.49
23	7 53 29.156 ^s 140.051	26 16 30.64 ^s -360.76	23	9 43 12.760 ^s 133.649	18 49 50.50 ^s -748.48
24	7 55 49.207 ^s	+26 10 29.88 ^s	24	9 45 26.409 ^s	+18 37 22.02 ^s

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent		Hour	Apparent	
	Right Ascension			Right Ascension	
October 28			October 30		
h	h	m s	h	h	m s
0	9 45	26.409	0	11 30	17.449
1	9 47	39.917	1	11 32	27.245
2	9 49	53.283	2	11 34	37.056
3	9 52	06.510	3	11 36	46.886
4	9 54	19.599	4	11 38	56.742
5	9 56	32.552	5	11 41	06.626
6	9 58	45.370	6	11 43	16.545
7	10 00	58.055	7	11 45	26.502
8	10 03	10.610	8	11 47	36.503
9	10 05	23.036	9	11 49	46.552
10	10 07	35.335	10	11 51	56.654
11	10 09	47.510	11	11 54	06.814
12	10 11	59.563	12	11 56	17.038
13	10 14	11.495	13	11 58	27.329
14	10 16	23.311	14	12 00	37.693
15	10 18	35.011	15	12 02	48.135
16	10 20	46.599	16	12 04	58.660
17	10 22	58.078	17	12 07	09.273
18	10 25	09.450	18	12 09	19.979
19	10 27	20.718	19	12 11	30.782
20	10 29	31.884	20	12 13	41.689
21	10 31	42.953	21	12 15	52.704
22	10 33	53.926	22	12 18	03.832
23	10 36	04.808	23	12 20	15.078
October 29			October 31		
0	10 38	15.601	0	12 22	26.447
1	10 40	26.308	1	12 24	37.945
2	10 42	36.933	2	12 26	49.577
3	10 44	47.480	3	12 29	01.347
4	10 46	57.951	4	12 31	13.261
5	10 49	08.351	5	12 33	25.324
6	10 51	18.682	6	12 35	37.541
7	10 53	28.949	7	12 37	49.917
8	10 55	39.155	8	12 40	02.458
9	10 57	49.305	9	12 42	15.167
10	10 59	59.401	10	12 44	28.051
11	11 02	09.448	11	12 46	41.115
12	11 04	19.450	12	12 48	54.363
13	11 06	29.410	13	12 51	07.800
14	11 08	39.334	14	12 53	21.433
15	11 10	49.224	15	12 55	35.264
16	11 12	59.085	16	12 57	49.300
17	11 15	08.922	17	13 00	03.546
18	11 17	18.738	18	13 02	18.006
19	11 19	28.538	19	13 04	32.685
20	11 21	38.326	20	13 06	47.589
21	11 23	48.106	21	13 09	02.721
22	11 25	57.884	22	13 11	18.088
23	11 28	07.663	23	13 13	33.692
24	11 30	17.449	24	13 15	49.540

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 1			November 3		
h	h m s	° ' "	h	h m s	° ' "
0	13 15 49.540	-7 15 02.81	0	15 10 29.989	-19 53 11.27
1	13 18 05.636	7 32 28.27	1	15 13 01.794	20 06 24.09
2	13 20 21.984	7 49 51.62	2	15 15 33.954	20 19 28.41
3	13 22 38.589	8 07 12.73	3	15 18 06.465	20 32 24.09
4	13 24 55.456	8 24 31.49	4	15 20 39.326	20 45 11.01
5	13 27 12.588	8 41 47.74	5	15 23 12.534	20 57 49.06
6	13 29 29.991	8 59 01.37	6	15 25 46.088	21 10 18.11
7	13 31 47.669	9 16 12.24	7	15 28 19.983	21 22 38.05
8	13 34 05.626	9 33 20.21	8	15 30 54.218	21 34 48.77
9	13 36 23.866	9 50 25.16	9	15 33 28.790	21 46 50.14
10	13 38 42.393	10 07 26.95	10	15 36 03.693	21 58 42.05
11	13 41 01.212	10 24 25.44	11	15 38 38.926	22 10 24.40
12	13 43 20.326	10 41 20.50	12	15 41 14.485	22 21 57.08
13	13 45 39.739	10 58 12.00	13	15 43 50.364	22 33 19.97
14	13 47 59.455	11 14 59.80	14	15 46 26.560	22 44 32.97
15	13 50 19.478	11 31 43.77	15	15 49 03.069	22 55 35.98
16	13 52 39.812	11 48 23.77	16	15 51 39.884	23 06 28.89
17	13 55 00.459	12 04 59.66	17	15 54 17.002	23 17 11.61
18	13 57 21.424	12 21 31.30	18	15 56 54.418	23 27 44.03
19	13 59 42.709	12 37 58.57	19	15 59 32.124	23 38 06.06
20	14 02 04.318	12 54 21.32	20	16 02 10.117	23 48 17.60
21	14 04 26.255	13 10 39.42	21	16 04 48.390	23 58 18.57
22	14 06 48.521	13 26 52.73	22	16 07 26.936	24 08 08.86
23	14 09 11.121	-13 43 01.11	23	16 10 05.750	-24 17 48.40
	142.935	-963.31		159.074	-568.70
November 2			November 4		
h	h m s	° ' "	h	h m s	° ' "
0	14 11 34.056	-13 59 04.42	0	16 12 44.824	-24 27 17.10
1	14 13 57.330	14 15 02.54	1	16 15 24.152	24 36 34.87
2	14 16 20.945	14 30 55.31	2	16 18 03.727	24 45 41.63
3	14 18 44.903	14 46 42.61	3	16 20 43.542	24 54 37.31
4	14 21 09.206	15 02 24.30	4	16 23 23.588	25 03 21.83
5	14 23 33.858	15 18 00.24	5	16 26 03.859	25 11 55.11
6	14 25 58.859	15 33 30.29	6	16 28 44.345	25 20 17.09
7	14 28 24.211	15 48 54.32	7	16 31 25.040	25 28 27.69
8	14 30 49.917	16 04 12.19	8	16 34 05.935	25 36 26.85
9	14 33 15.978	16 19 23.77	9	16 36 47.021	25 44 14.51
10	14 35 42.395	16 34 28.92	10	16 39 28.290	25 51 50.60
11	14 38 09.169	16 49 27.51	11	16 42 09.732	25 59 15.07
12	14 40 36.302	17 04 19.39	12	16 44 51.339	26 06 27.86
13	14 43 03.794	17 19 04.44	13	16 47 33.102	26 13 28.92
14	14 45 31.645	17 33 42.53	14	16 50 15.010	26 20 18.20
15	14 47 59.858	17 48 13.51	15	16 52 57.055	26 26 55.65
16	14 50 28.431	18 02 37.27	16	16 55 39.227	26 33 21.23
17	14 52 57.365	18 16 53.65	17	16 58 21.515	26 39 34.90
18	14 55 26.661	18 31 02.55	18	17 01 03.910	26 45 36.62
19	14 57 56.317	18 45 03.82	19	17 03 46.401	26 51 26.35
20	15 00 26.334	18 58 57.33	20	17 06 28.979	26 57 04.07
21	15 02 56.710	19 12 42.96	21	17 09 11.633	27 02 29.74
22	15 05 27.445	19 26 20.57	22	17 11 54.352	27 07 43.33
23	15 07 58.539	19 39 50.05	23	17 14 37.126	27 12 44.83
24	15 10 29.989	-19 53 11.27	24	17 17 19.944	-27 17 34.21
	151.450	-801.22		162.818	-289.38

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 5							November 7						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	17 17	19.944	162.851	-27 17 34.21	-277.24		0	19 24	55.896	152.196	-27 16 37.39	+272.39	
1	17 20	02.795	162.874	27 22 11.45	265.10		1	19 27	28.092	151.767	27 12 05.00	282.24	
2	17 22	45.669	162.885	27 26 36.55	252.93		2	19 29	59.859	151.334	27 07 22.76	292.00	
3	17 25	28.554	162.886	27 30 49.48	240.76		3	19 32	31.193	150.894	27 02 30.76	301.66	
4	17 28	11.440	162.875	27 34 50.24	228.58		4	19 35	02.087	150.451	26 57 29.10	311.23	
5	17 30	54.315	162.853	27 38 38.82	216.41		5	19 37	32.538	150.002	26 52 17.87	320.70	
6	17 33	37.168	162.821	27 42 15.23	204.23		6	19 40	02.540	149.549	26 46 57.17	330.09	
7	17 36	19.989	162.777	27 45 39.46	192.05		7	19 42	32.089	149.093	26 41 27.08	339.37	
8	17 39	02.766	162.721	27 48 51.51	179.88		8	19 45	01.182	148.631	26 35 47.71	348.56	
9	17 41	45.487	162.655	27 51 51.39	167.72		9	19 47	29.813	148.167	26 29 59.15	357.66	
10	17 44	28.142	162.577	27 54 39.11	155.58		10	19 49	57.980	147.699	26 24 01.49	366.65	
11	17 47	10.719	162.489	27 57 14.69	143.43		11	19 52	25.679	147.227	26 17 54.84	375.55	
12	17 49	53.208	162.389	27 59 38.12	131.33		12	19 54	52.906	146.753	26 11 39.29	384.35	
13	17 52	35.597	162.278	28 01 49.45	119.22		13	19 57	19.659	146.276	26 05 14.94	393.05	
14	17 55	17.875	162.156	28 03 48.67	107.16		14	19 59	45.935	145.796	25 58 41.89	401.65	
15	17 58	00.031	162.023	28 05 35.83	95.10		15	20 02	11.731	145.314	25 52 00.24	410.16	
16	18 00	42.054	161.879	28 07 10.93	83.09		16	20 04	37.045	144.830	25 45 10.08	418.56	
17	18 03	23.933	161.723	28 08 34.02	71.10		17	20 07	01.875	144.343	25 38 11.52	426.87	
18	18 06	05.656	161.558	28 09 45.12	59.15		18	20 09	26.218	143.855	25 31 04.65	435.08	
19	18 08	47.214	161.382	28 10 44.27	47.23		19	20 11	50.073	143.365	25 23 49.57	443.19	
20	18 11	28.596	161.194	28 11 31.50	35.35		20	20 14	13.438	142.874	25 16 26.38	451.20	
21	18 14	09.790	160.996	28 12 06.85	23.52		21	20 16	36.312	142.382	25 08 55.18	459.11	
22	18 16	50.786	160.788	28 12 30.37	11.73		22	20 18	58.694	141.889	25 01 16.07	466.92	
23	18 19	31.574	160.569	-28 12 42.10	0.02		23	20 21	20.583	141.394	-24 53 29.15	+474.63	
November 6							November 8						
0	18 22	12.143	160.341	-28 12 42.08	+11.71		0	20 23	41.977	140.901	-24 45 34.52	+482.25	
1	18 24	52.484	160.101	28 12 30.37	23.36		1	20 26	02.878	140.405	24 37 32.27	489.76	
2	18 27	32.585	159.852	28 12 07.01	34.95		2	20 28	23.283	139.910	24 29 22.51	497.18	
3	18 30	12.437	159.593	28 11 32.06	46.48		3	20 30	43.193	139.415	24 21 05.33	504.50	
4	18 32	52.030	159.325	28 10 45.58	57.96		4	20 33	02.608	138.919	24 12 40.83	511.72	
5	18 35	31.355	159.047	28 09 47.62	69.38		5	20 35	21.527	138.425	24 04 09.11	518.84	
6	18 38	10.402	158.759	28 08 38.24	80.73		6	20 37	39.952	137.930	23 55 30.27	525.88	
7	18 40	49.161	158.463	28 07 17.51	92.02		7	20 39	57.882	137.437	23 46 44.40	532.81	
8	18 43	27.624	158.157	28 05 45.49	103.24		8	20 42	15.319	136.944	23 37 51.59	539.63	
9	18 46	05.781	157.843	28 04 02.25	114.40		9	20 44	32.263	136.451	23 28 51.96	546.37	
10	18 48	43.624	157.519	28 02 07.85	125.48		10	20 46	48.714	135.961	23 19 45.59	553.02	
11	18 51	21.143	157.188	28 00 02.37	136.50		11	20 49	04.675	135.471	23 10 32.57	559.56	
12	18 53	58.331	156.847	27 57 45.87	147.43		12	20 51	20.146	134.983	23 01 13.01	566.02	
13	18 56	35.178	156.500	27 55 18.44	158.29		13	20 53	35.129	134.497	22 51 46.99	572.38	
14	18 59	11.678	156.143	27 52 40.15	169.09		14	20 55	49.626	134.011	22 42 14.61	578.64	
15	19 01	47.821	155.780	27 49 51.06	179.79		15	20 58	03.637	133.528	22 32 35.97	584.81	
16	19 04	23.601	155.409	27 46 51.27	190.41		16	21 00	17.165	133.046	22 22 51.16	590.90	
17	19 06	59.010	155.030	27 43 40.86	200.97		17	21 02	30.211	132.568	22 13 00.26	596.89	
18	19 09	34.040	154.645	27 40 19.89	211.42		18	21 04	42.779	132.090	22 03 03.37	602.78	
19	19 12	08.685	154.252	27 36 48.47	221.81		19	21 06	54.869	131.616	21 53 00.59	608.59	
20	19 14	42.937	153.854	27 33 06.66	232.09		20	21 09	06.485	131.143	21 42 52.00	614.31	
21	19 17	16.791	153.448	27 29 14.57	242.31		21	21 11	17.628	130.674	21 32 37.69	619.94	
22	19 19	50.239	153.037	27 25 12.26	252.42		22	21 13	28.302	130.206	21 22 17.75	625.47	
23	19 22	23.276	152.620	27 20 59.84	+262.45		23	21 15	38.508	129.742	21 11 52.28	+630.93	
24	19 24	55.896		-27 16 37.39			24	21 17	48.250		-21 01 21.35		

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 9			November 11		
h	h m s	° ' " s	h	h m s	° ' " s
0	21 17 48.250	129.281 -21 01 21.35	0	22 53 42.344	111.773 -11 15 28.35
1	21 19 57.531	128.822 20 50 45.05	1	22 55 34.117	111.521 11 02 03.08
2	21 22 06.353	128.367 20 40 03.48	2	22 57 25.638	111.273 10 48 35.84
3	21 24 14.720	127.914 20 29 16.71	3	22 59 16.911	111.029 10 35 06.72
4	21 26 22.634	127.465 20 18 24.84	4	23 01 07.940	110.791 10 21 35.74
5	21 28 30.099	127.019 20 07 27.94	5	23 02 58.731	110.557 10 08 02.98
6	21 30 37.118	126.577 19 56 26.11	6	23 04 49.288	110.328 9 54 28.48
7	21 32 43.695	126.138 19 45 19.41	7	23 06 39.616	110.103 9 40 52.29
8	21 34 49.833	125.703 19 34 07.94	8	23 08 29.719	109.885 9 27 14.47
9	21 36 55.536	125.271 19 22 51.78	9	23 10 19.604	109.670 9 13 35.07
10	21 39 00.807	124.842 19 11 31.01	10	23 12 09.274	109.460 8 59 54.13
11	21 41 05.649	124.419 19 00 05.70	11	23 13 58.734	109.255 8 46 11.72
12	21 43 10.068	123.998 18 48 35.94	12	23 15 47.989	109.054 8 32 27.87
13	21 45 14.066	123.582 18 37 01.80	13	23 17 37.043	108.860 8 18 42.64
14	21 47 17.648	123.169 18 25 23.37	14	23 19 25.903	108.668 8 04 56.08
15	21 49 20.817	122.761 18 13 40.72	15	23 21 14.571	108.483 7 51 08.24
16	21 51 23.578	122.356 18 01 53.93	16	23 23 03.054	108.301 7 37 19.17
17	21 53 25.934	121.955 17 50 03.06	17	23 24 51.355	108.126 7 23 28.91
18	21 55 27.889	121.560 17 38 08.21	18	23 26 39.481	107.953 7 09 37.51
19	21 57 29.449	121.167 17 26 09.43	19	23 28 27.434	107.786 6 55 45.02
20	21 59 30.616	120.780 17 14 06.81	20	23 30 15.220	107.624 6 41 51.49
21	22 01 31.396	120.396 17 02 00.42	21	23 32 02.844	107.467 6 27 56.97
22	22 03 31.792	120.018 16 49 50.33	22	23 33 50.311	107.314 6 14 01.49
23	22 05 31.810	119.642 -16 37 36.60	23	23 35 37.625	107.165 -6 00 05.12
November 10			November 12		
0	22 07 31.452	119.273 -16 25 19.32	0	23 37 24.790	107.023 -5 46 07.89
1	22 09 30.725	118.906 16 12 58.55	1	23 39 11.813	106.883 5 32 09.85
2	22 11 29.631	118.545 16 00 34.35	2	23 40 58.696	106.749 5 18 11.05
3	22 13 28.176	118.188 15 48 06.81	3	23 42 45.445	106.620 5 04 11.53
4	22 15 26.364	117.836 15 35 35.98	4	23 44 32.065	106.495 4 50 11.33
5	22 17 24.200	117.489 15 23 01.94	5	23 46 18.560	106.374 4 36 10.51
6	22 19 21.689	117.145 15 10 24.74	6	23 48 04.934	106.259 4 22 09.10
7	22 21 18.834	116.807 14 57 44.46	7	23 49 51.193	106.148 4 08 07.15
8	22 23 15.641	116.472 14 45 01.16	8	23 51 37.341	106.042 3 54 04.71
9	22 25 12.113	116.144 14 32 14.91	9	23 53 23.383	105.940 3 40 01.82
10	22 27 08.257	115.819 14 19 25.76	10	23 55 09.323	105.842 3 25 58.52
11	22 29 04.076	115.499 14 06 33.79	11	23 56 55.165	105.750 3 11 54.86
12	22 30 59.575	115.184 13 53 39.05	12	23 58 40.915	105.662 2 57 50.88
13	22 32 54.759	114.874 13 40 41.60	13	00 02 26.577	105.578 2 43 46.63
14	22 34 49.633	114.568 13 27 41.51	14	00 12 12.155	105.499 2 29 42.14
15	22 36 44.201	114.267 13 14 38.85	15	00 57.654	105.425 2 15 37.47
16	22 38 38.468	113.970 13 01 33.65	16	00 43.079	105.355 2 01 32.64
17	22 40 32.438	113.680 12 48 26.00	17	00 28.434	105.289 1 47 27.72
18	22 42 26.118	113.393 12 35 15.94	18	00 13.723	105.228 1 33 22.74
19	22 44 19.511	113.111 12 22 03.54	19	00 58.951	105.171 1 19 17.73
20	22 46 12.622	112.834 12 08 48.85	20	01 44.122	105.119 1 05 12.76
21	22 48 05.456	112.561 11 55 31.93	21	01 29.241	105.071 0 51 07.85
22	22 49 58.017	112.295 11 42 12.84	22	01 14.312	105.028 0 37 03.05
23	22 51 50.312	112.032 11 28 51.63	23	01 59.340	104.989 0 22 58.40
24	22 53 42.344	-11 15 28.35	24	01 44.329	-0 08 53.95

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 13							November 15						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	0	19	44.329	104.955	-	0 08 53.95	0	1	44	21.046	108.191	+10 48 54.72	+782.22
1	0	21	29.284	104.924	+	0 05 10.26	1	1	46	09.237	108.352	11 01 56.94	779.82
2	0	23	14.208	104.899		0 19 14.20	2	1	47	57.589	108.519	11 14 56.76	777.38
3	0	24	59.107	104.877		0 33 17.81	3	1	49	46.108	108.689	11 27 54.14	774.89
4	0	26	43.984	104.861		0 47 21.05	4	1	51	34.797	108.862	11 40 49.03	772.35
5	0	28	28.845	104.847		1 01 23.90	5	1	53	23.659	109.039	11 53 41.38	769.76
6	0	30	13.692	104.839		1 15 26.29	6	1	55	12.698	109.218	12 06 31.14	767.12
7	0	31	58.531	104.835		1 29 28.19	7	1	57	01.916	109.402	12 19 18.26	764.44
8	0	33	43.366	104.835		1 43 29.56	8	1	58	51.318	109.589	12 32 02.70	761.70
9	0	35	28.201	104.840		1 57 30.35	9	2	00	40.907	109.779	12 44 44.40	758.91
10	0	37	13.041	104.848		2 11 30.52	10	2	02	30.686	109.973	12 57 23.31	756.08
11	0	38	57.889	104.862		2 25 30.04	11	2	04	20.659	110.169	13 09 59.39	753.19
12	0	40	42.751	104.878		2 39 28.85	12	2	06	10.828	110.370	13 22 32.58	750.25
13	0	42	27.629	104.900		2 53 26.92	13	2	08	01.198	110.573	13 35 02.83	747.26
14	0	44	12.529	104.926		3 07 24.20	14	2	09	51.771	110.779	13 47 30.09	744.23
15	0	45	57.455	104.956		3 21 20.65	15	2	11	42.550	110.989	13 59 54.32	741.14
16	0	47	42.411	104.989		3 35 16.23	16	2	13	33.539	111.202	14 12 15.46	737.99
17	0	49	27.400	105.028		3 49 10.90	17	2	15	24.741	111.418	14 24 33.45	734.80
18	0	51	12.428	105.070		4 03 04.61	18	2	17	16.159	111.637	14 36 48.25	731.56
19	0	52	57.498	105.117		4 16 57.32	19	2	19	07.796	111.858	14 48 59.81	728.26
20	0	54	42.615	105.167		4 30 48.99	20	2	20	59.654	112.084	15 01 08.07	724.90
21	0	56	27.782	105.222		4 44 39.57	21	2	22	51.738	112.311	15 13 12.97	721.51
22	0	58	13.004	105.281		4 58 29.02	22	2	24	44.049	112.543	15 25 14.48	718.05
23	0	59	58.285	105.344	+	5 12 17.30	23	2	26	36.592	112.776	+15 37 12.53	+714.54
November 14							November 16						
0	1	01	43.629	105.410	+	5 26 04.37	0	2	28	29.368	113.012	+15 49 07.07	+710.98
1	1	03	29.039	105.482		5 39 50.18	1	2	30	22.380	113.251	16 00 58.05	707.36
2	1	05	14.521	105.557		5 53 34.69	2	2	32	15.631	113.494	16 12 45.41	703.69
3	1	07	00.078	105.635		6 07 17.85	3	2	34	09.125	113.738	16 24 29.10	699.97
4	1	08	45.713	105.719		6 20 59.63	4	2	36	02.863	113.985	16 36 09.07	696.18
5	1	10	31.432	105.806		6 34 39.97	5	2	37	56.848	114.235	16 47 45.25	692.36
6	1	12	17.238	105.897		6 48 18.83	6	2	39	51.083	114.488	16 59 17.61	688.46
7	1	14	03.135	105.991		7 01 56.18	7	2	41	45.571	114.742	17 10 46.07	684.52
8	1	15	49.126	106.091		7 15 31.96	8	2	43	40.313	115.000	17 22 10.59	680.52
9	1	17	35.217	106.193		7 29 06.13	9	2	45	35.313	115.259	17 33 31.11	676.47
10	1	19	21.410	106.300		7 42 38.64	10	2	47	30.572	115.521	17 44 47.58	672.36
11	1	21	07.710	106.410		7 56 09.46	11	2	49	26.093	115.786	17 55 59.94	668.19
12	1	22	54.120	106.525		8 09 38.53	12	2	51	21.879	116.052	18 07 08.13	663.97
13	1	24	40.645	106.643		8 23 05.81	13	2	53	17.931	116.321	18 18 12.10	659.69
14	1	26	27.288	106.764		8 36 31.26	14	2	55	14.252	116.591	18 29 11.79	655.35
15	1	28	14.052	106.891		8 49 54.83	15	2	57	10.843	116.864	18 40 07.14	650.96
16	1	30	00.943	107.020		9 03 16.47	16	2	59	07.707	117.139	18 50 58.10	646.52
17	1	31	47.963	107.154		9 16 36.14	17	3	01	04.846	117.416	19 01 44.62	642.00
18	1	33	35.117	107.291		9 29 53.80	18	3	03	02.262	117.694	19 12 26.62	637.44
19	1	35	22.408	107.431		9 43 09.39	19	3	04	59.956	117.975	19 23 04.06	632.83
20	1	37	09.839	107.576		9 56 22.86	20	3	06	57.931	118.257	19 33 36.89	628.14
21	1	38	57.415	107.724		10 09 34.18	21	3	08	56.188	118.540	19 44 05.03	623.40
22	1	40	45.139	107.876		10 22 43.30	22	3	10	54.728	118.826	19 54 28.43	618.62
23	1	42	33.015	108.031		10 35 50.16	23	3	12	53.554	119.113	20 04 47.05	613.76
24	1	44	21.046		+	10 48 54.72	24	3	14	52.667		+20 15 00.81	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 17			November 19		
h	h m s	° ' " S	h	h m s	° ' " S
0	3 14 52.667	119.401	0	4 55 56.614	133.256
1	3 16 52.068	119.691	1	4 58 09.870	133.505
2	3 18 51.759	119.981	2	5 00 23.375	133.751
3	3 20 51.740	120.274	3	5 02 37.126	133.993
4	3 22 52.014	120.568	4	5 04 51.119	134.232
5	3 24 52.582	120.861	5	5 07 05.351	134.467
6	3 26 53.443	121.158	6	5 09 19.818	134.698
7	3 28 54.601	121.453	7	5 11 34.516	134.926
8	3 30 56.054	121.751	8	5 13 49.442	135.149
9	3 32 57.805	122.049	9	5 16 04.591	135.369
10	3 34 59.854	122.347	10	5 18 19.960	135.584
11	3 37 02.201	122.647	11	5 20 35.544	135.795
12	3 39 04.848	122.946	12	5 22 51.339	136.003
13	3 41 07.794	123.247	13	5 25 07.342	136.205
14	3 43 11.041	123.546	14	5 27 23.547	136.403
15	3 45 14.587	123.848	15	5 29 39.950	136.597
16	3 47 18.435	124.148	16	5 31 56.547	136.785
17	3 49 22.583	124.449	17	5 34 13.332	136.970
18	3 51 27.032	124.750	18	5 36 30.302	137.150
19	3 53 31.782	125.051	19	5 38 47.452	137.324
20	3 55 36.833	125.351	20	5 41 04.776	137.493
21	3 57 42.184	125.651	21	5 43 22.269	137.659
22	3 59 47.835	125.951	22	5 45 39.928	137.818
23	4 01 53.786	126.250	23	5 47 57.746	137.972
November 18			November 20		
h	h m s	° ' " S	h	h m s	° ' " S
0	4 04 00.036	126.549	0	5 50 15.718	138.122
1	4 06 06.585	126.846	1	5 52 33.840	138.266
2	4 08 13.431	127.143	2	5 54 52.106	138.405
3	4 10 20.574	127.440	3	5 57 10.511	138.539
4	4 12 28.014	127.734	4	5 59 29.050	138.666
5	4 14 35.748	128.029	5	6 01 47.716	138.790
6	4 16 43.777	128.321	6	6 04 06.506	138.906
7	4 18 52.098	128.612	7	6 06 25.412	139.018
8	4 21 00.710	128.902	8	6 08 44.430	139.124
9	4 23 09.612	129.190	9	6 11 03.554	139.225
10	4 25 18.802	129.477	10	6 13 22.779	139.320
11	4 27 28.279	129.762	11	6 15 42.099	139.409
12	4 29 38.041	130.045	12	6 18 01.508	139.492
13	4 31 48.086	130.325	13	6 20 21.000	139.571
14	4 33 58.411	130.605	14	6 22 40.571	139.642
15	4 36 09.016	130.882	15	6 25 00.213	139.710
16	4 38 19.898	131.156	16	6 27 19.923	139.770
17	4 40 31.054	131.428	17	6 29 39.693	139.825
18	4 42 42.482	131.697	18	6 31 59.518	139.874
19	4 44 54.179	131.964	19	6 34 19.392	139.919
20	4 47 06.143	132.229	20	6 36 39.311	139.956
21	4 49 18.372	132.490	21	6 38 59.267	139.988
22	4 51 30.862	132.748	22	6 41 19.255	140.015
23	4 53 43.610	133.004	23	6 43 39.270	140.035
24	4 55 56.614		24	6 45 59.305	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
November 21							November 23						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	6 45	59	305	140.051	+28 00	40.91	0	8 36	46	583	135.276	+23 54	18.66
1	6 48	19	356	140.061	27 58	58.88	1	8 39	01	859	135.098	23 45	45.16
2	6 50	39	417	140.064	27 57	07.90	2	8 41	16	957	134.919	23 37	03.85
3	6 52	59	481	140.063	27 55	07.98	3	8 43	31	876	134.739	23 28	14.76
4	6 55	19	544	140.055	27 52	59.11	4	8 45	46	615	134.557	23 19	17.93
5	6 57	39	599	140.043	27 50	41.31	5	8 48	01	172	134.375	23 10	13.42
6	6 59	59	642	140.024	27 48	14.57	6	8 50	15	547	134.191	23 01	01.26
7	7 02	19	666	140.001	27 45	38.89	7	8 52	29	738	134.007	22 51	41.50
8	7 04	39	667	139.972	27 42	54.29	8	8 54	43	745	133.822	22 42	14.19
9	7 06	59	639	139.938	27 40	00.76	9	8 56	57	567	133.636	22 32	39.37
10	7 09	19	577	139.898	27 36	58.32	10	8 59	11	203	133.451	22 22	57.10
11	7 11	39	475	139.854	27 33	46.98	11	9 01	24	654	133.264	22 13	07.41
12	7 13	59	329	139.803	27 30	26.73	12	9 03	37	918	133.077	22 03	10.37
13	7 16	19	132	139.748	27 26	57.61	13	9 05	50	995	132.891	21 53	06.01
14	7 18	38	880	139.688	27 23	19.60	14	9 08	03	886	132.704	21 42	54.39
15	7 20	58	568	139.623	27 19	32.74	15	9 10	16	590	132.517	21 32	35.55
16	7 23	18	191	139.554	27 15	37.03	16	9 12	29	107	132.331	21 22	09.55
17	7 25	37	745	139.478	27 11	32.49	17	9 14	41	438	132.145	21 11	36.43
18	7 27	57	223	139.399	27 07	19.13	18	9 16	53	583	131.960	21 00	56.25
19	7 30	16	622	139.315	27 02	56.98	19	9 19	05	543	131.774	20 50	09.07
20	7 32	35	937	139.226	26 58	26.04	20	9 21	17	317	131.590	20 39	14.92
21	7 34	55	163	139.133	26 53	46.35	21	9 23	28	907	131.407	20 28	13.86
22	7 37	14	296	139.035	26 48	57.91	22	9 25	40	314	131.224	20 17	05.95
23	7 39	33	331	138.933	+26 44	00.75	23	9 27	51	538	131.041	+20 05	51.24
						-305.85							-681.46
November 22							November 24						
0	7 41	52	264	138.827	+26 38	54.90	0	9 30	02	579	130.862	+19 54	29.78
1	7 44	11	091	138.717	26 33	40.37	1	9 32	13	441	130.681	19 43	01.62
2	7 46	29	808	138.603	26 28	17.19	2	9 34	24	122	130.504	19 31	26.82
3	7 48	48	411	138.484	26 22	45.38	3	9 36	34	626	130.326	19 19	45.44
4	7 51	06	895	138.362	26 17	04.98	4	9 38	44	952	130.151	19 07	57.53
5	7 53	25	257	138.236	26 11	16.00	5	9 40	55	103	129.977	18 56	03.14
6	7 55	43	493	138.106	26 05	18.48	6	9 43	05	080	129.805	18 44	02.33
7	7 58	01	599	137.974	25 59	12.44	7	9 45	14	885	129.635	18 31	55.16
8	8 00	19	573	137.837	25 52	57.92	8	9 47	24	520	129.466	18 19	41.67
9	8 02	37	410	137.697	25 46	34.94	9	9 49	33	986	129.300	18 07	21.94
10	8 04	55	107	137.554	25 40	03.53	10	9 51	43	286	129.134	17 54	56.01
11	8 07	12	661	137.408	25 33	23.73	11	9 53	52	420	128.973	17 42	23.94
12	8 09	30	069	137.258	25 26	35.58	12	9 56	01	393	128.812	17 29	45.79
13	8 11	47	327	137.107	25 19	39.09	13	9 58	10	205	128.654	17 17	01.62
14	8 14	04	434	136.952	25 12	34.32	14	10 00	18	859	128.499	17 04	11.48
15	8 16	21	386	136.794	25 05	21.29	15	10 02	27	358	128.345	16 51	15.44
16	8 18	38	180	136.634	24 58	00.03	16	10 04	35	703	128.195	16 38	13.55
17	8 20	54	814	136.472	24 50	30.60	17	10 06	43	898	128.048	16 25	05.87
18	8 23	11	286	136.307	24 42	53.02	18	10 08	51	946	127.902	16 11	52.46
19	8 25	27	593	136.140	24 35	07.33	19	10 10	59	848	127.759	15 58	33.38
20	8 27	43	733	135.971	24 27	13.57	20	10 13	07	607	127.621	15 45	08.70
21	8 29	59	704	135.799	24 19	11.79	21	10 15	15	228	127.483	15 31	38.46
22	8 32	15	503	135.627	24 11	02.01	22	10 17	22	711	127.351	15 18	02.73
23	8 34	31	130	135.453	24 02	44.29	23	10 19	30	062	127.220	15 04	21.58
24	8 36	46	583		+23 54	18.66	24	10 21	37	282		+14 50	35.06
						-505.63							-826.52

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 25			November 27		
h	h m s	° ' "	h	h m s	° ' "
0	10 21 37.282	+14 50 35.06	0	12 02 07.087	+2 25 43.39
1	10 23 44.374	14 36 43.24	1	12 04 12.971	2 08 56.97
2	10 25 51.343	14 22 46.17	2	12 06 18.949	1 52 08.78
3	10 27 58.191	14 08 43.92	3	12 08 25.029	1 35 18.90
4	10 30 04.922	13 54 36.55	4	12 10 31.214	1 18 27.42
5	10 32 11.540	13 40 24.13	5	12 12 37.512	1 01 34.44
6	10 34 18.047	13 26 06.72	6	12 14 43.926	0 44 40.03
7	10 36 24.447	13 11 44.37	7	12 16 50.463	0 27 44.30
8	10 38 30.745	12 57 17.17	8	12 18 57.129	+0 10 47.32
9	10 40 36.943	12 42 45.16	9	12 21 03.928	-0 06 10.81
10	10 42 43.046	12 28 08.41	10	12 23 10.867	0 23 10.00
11	10 44 49.057	12 13 27.00	11	12 25 17.950	0 40 10.15
12	10 46 54.981	11 58 40.98	12	12 27 25.184	0 57 11.18
13	10 49 00.820	11 43 50.42	13	12 29 32.574	1 14 12.98
14	10 51 06.580	11 28 55.39	14	12 31 40.126	1 31 15.47
15	10 53 12.265	11 13 55.95	15	12 33 47.845	1 48 18.55
16	10 55 17.878	10 58 52.17	16	12 35 55.737	2 05 22.12
17	10 57 23.424	10 43 44.11	17	12 38 03.808	2 22 26.08
18	10 59 28.907	10 28 31.85	18	12 40 12.062	2 39 30.34
19	11 01 34.331	10 13 15.46	19	12 42 20.507	2 56 34.80
20	11 03 39.701	9 57 54.99	20	12 44 29.146	3 13 39.35
21	11 05 45.021	9 42 30.53	21	12 46 37.987	3 30 43.90
22	11 07 50.295	9 27 02.13	22	12 48 47.034	3 47 48.35
23	11 09 55.528	+9 11 29.88	23	12 50 56.293	-4 04 52.58
	125.197	-936.05		129.477	-1023.93
November 26			November 28		
h	h m s	° ' "	h	h m s	° ' "
0	11 12 00.725	+8 55 53.83	0	12 53 05.770	-4 21 56.51
1	11 14 05.890	8 40 14.07	1	12 55 15.470	4 39 00.02
2	11 16 11.028	8 24 30.65	2	12 57 25.398	4 56 03.00
3	11 18 16.144	8 08 43.66	3	12 59 35.561	5 13 05.36
4	11 20 21.241	7 52 53.17	4	13 01 45.964	5 30 06.99
5	11 22 26.326	7 36 59.24	5	13 03 56.612	5 47 07.77
6	11 24 31.402	7 21 01.96	6	13 06 07.511	6 04 07.60
7	11 26 36.475	7 05 01.39	7	13 08 18.666	6 21 06.37
8	11 28 41.550	6 48 57.61	8	13 10 30.082	6 38 03.97
9	11 30 46.631	6 32 50.70	9	13 12 41.766	6 55 00.29
10	11 32 51.724	6 16 40.72	10	13 14 53.722	7 11 55.21
11	11 34 56.833	6 00 27.77	11	13 17 05.956	7 28 48.62
12	11 37 01.963	5 44 11.90	12	13 19 18.473	7 45 40.41
13	11 39 07.120	5 27 53.20	13	13 21 31.278	8 02 30.47
14	11 41 12.309	5 11 31.75	14	13 23 44.376	8 19 18.67
15	11 43 17.535	4 55 07.63	15	13 25 57.774	8 36 04.90
16	11 45 22.803	4 38 40.91	16	13 28 11.475	8 52 49.04
17	11 47 28.118	4 22 11.67	17	13 30 25.485	9 09 30.97
18	11 49 33.485	4 05 40.00	18	13 32 39.808	9 26 10.58
19	11 51 38.910	3 49 05.98	19	13 34 54.451	9 42 47.74
20	11 53 44.398	3 32 29.68	20	13 37 09.417	9 59 22.34
21	11 55 49.955	3 15 51.18	21	13 39 24.712	10 15 54.25
22	11 57 55.585	2 59 10.58	22	13 41 40.340	10 32 23.34
23	12 00 01.294	2 42 27.96	23	13 43 56.307	10 48 49.50
24	12 02 07.087	+2 25 43.39	24	13 46 12.616	-11 05 12.61
	125.793	-1004.57		136.309	-983.11

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
November 29			December 1		
h	h m s	° ' "	h	h m s	° ' "
0	13 46 12.616	-11 05 12.61	0	15 43 01.556	-22 28 55.15
1	13 48 29.272	11 21 32.53	1	15 45 37.785	22 40 06.82
2	13 50 46.280	11 37 49.13	2	15 48 14.409	22 51 08.87
3	13 53 03.645	11 54 02.31	3	15 50 51.423	23 02 01.16
4	13 55 21.370	12 10 11.92	4	15 53 28.823	23 12 43.59
5	13 57 39.459	12 26 17.84	5	15 56 06.603	23 23 16.03
6	13 59 57.918	12 42 19.94	6	15 58 44.757	23 33 38.37
7	14 02 16.749	12 58 18.09	7	16 01 23.282	23 43 50.51
8	14 04 35.958	13 14 12.16	8	16 04 02.170	23 53 52.32
9	14 06 55.547	13 30 02.02	9	16 06 41.416	24 03 43.70
10	14 09 15.521	13 45 47.54	10	16 09 21.014	24 13 24.54
11	14 11 35.882	14 01 28.59	11	16 12 00.956	24 22 54.75
12	14 13 56.636	14 17 05.04	12	16 14 41.237	24 32 14.20
13	14 16 17.784	14 32 36.75	13	16 17 21.849	24 41 22.82
14	14 18 39.331	14 48 03.59	14	16 20 02.784	24 50 20.49
15	14 21 01.278	15 03 25.43	15	16 22 44.035	24 59 07.12
16	14 23 23.631	15 18 42.13	16	16 25 25.595	25 07 42.62
17	14 25 46.390	15 33 53.56	17	16 28 07.454	25 16 06.89
18	14 28 09.559	15 48 59.58	18	16 30 49.604	25 24 19.85
19	14 30 33.141	16 04 00.06	19	16 33 32.037	25 32 21.42
20	14 32 57.138	16 18 54.86	20	16 36 14.744	25 40 11.50
21	14 35 21.552	16 33 43.85	21	16 38 57.715	25 47 50.01
22	14 37 46.385	16 48 26.90	22	16 41 40.941	25 55 16.89
23	14 40 11.639	-17 03 03.86	23	16 44 24.413	-26 02 32.04
November 30			December 2		
h	h m s	° ' "	h	h m s	° ' "
0	14 42 37.316	-17 17 34.60	0	16 47 08.121	-26 09 35.41
1	14 45 03.417	17 31 58.98	1	16 49 52.054	26 16 26.91
2	14 47 29.944	17 46 16.87	2	16 52 36.202	26 23 06.49
3	14 49 56.899	18 00 28.13	3	16 55 20.555	26 29 34.08
4	14 52 24.281	18 14 32.63	4	16 58 05.102	26 35 49.62
5	14 54 52.093	18 28 30.22	5	17 00 49.832	26 41 53.05
6	14 57 20.334	18 42 20.78	6	17 03 34.734	26 47 44.31
7	14 59 49.005	18 56 04.17	7	17 06 19.796	26 53 23.36
8	15 02 18.106	19 09 40.25	8	17 09 05.007	26 58 50.14
9	15 04 47.638	19 23 08.88	9	17 11 50.356	27 04 04.62
10	15 07 17.599	19 36 29.94	10	17 14 35.830	27 09 06.75
11	15 09 47.990	19 49 43.29	11	17 17 21.418	27 13 56.48
12	15 12 18.810	20 02 48.79	12	17 20 07.108	27 18 33.80
13	15 14 50.059	20 15 46.32	13	17 22 52.887	27 22 58.65
14	15 17 21.734	20 28 35.73	14	17 25 38.743	27 27 11.02
15	15 19 53.835	20 41 16.90	15	17 28 24.664	27 31 10.88
16	15 22 26.360	20 53 49.70	16	17 31 10.637	27 34 58.21
17	15 24 59.307	21 06 13.99	17	17 33 56.649	27 38 32.99
18	15 27 32.675	21 18 29.65	18	17 36 42.689	27 41 55.21
19	15 30 06.460	21 30 36.54	19	17 39 28.742	27 45 04.85
20	15 32 40.661	21 42 34.55	20	17 42 14.796	27 48 01.90
21	15 35 15.274	21 54 23.54	21	17 45 00.839	27 50 46.37
22	15 37 50.296	22 06 03.38	22	17 47 46.857	27 53 18.25
23	15 40 25.725	22 17 33.96	23	17 50 32.838	27 55 37.53
24	15 43 01.556	-22 28 55.15	24	17 53 18.768	-27 57 44.24

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 3			December 5		
h	h m s	° ' "	h	h m s	° ' "
0	17 53 18.768	165.867	0	20 01 14.098	150.005
1	17 56 04.635	165.791	1	20 03 44.103	149.494
2	17 58 50.426	165.701	2	20 06 13.597	148.978
3	18 01 36.127	165.600	3	20 08 42.575	148.459
4	18 04 21.727	165.485	4	20 11 11.034	147.937
5	18 07 07.212	165.357	5	20 13 38.971	147.415
6	18 09 52.569	165.217	6	20 16 06.386	146.888
7	18 12 37.786	165.064	7	20 18 33.274	146.360
8	18 15 22.850	164.898	8	20 20 59.634	145.830
9	18 18 07.748	164.721	9	20 23 25.464	145.299
10	18 20 52.469	164.530	10	20 25 50.763	144.766
11	18 23 36.999	164.328	11	20 28 15.529	144.233
12	18 26 21.327	164.113	12	20 30 39.762	143.699
13	18 29 05.440	163.886	13	20 33 03.461	143.163
14	18 31 49.326	163.649	14	20 35 26.624	142.628
15	18 34 32.975	163.398	15	20 37 49.252	142.093
16	18 37 16.373	163.137	16	20 40 11.345	141.556
17	18 39 59.510	162.864	17	20 42 32.901	141.021
18	18 42 42.374	162.580	18	20 44 53.922	140.487
19	18 45 24.954	162.286	19	20 47 14.409	139.951
20	18 48 07.240	161.979	20	20 49 34.360	139.419
21	18 50 49.219	161.664	21	20 51 53.779	138.885
22	18 53 30.883	161.337	22	20 54 12.664	138.354
23	18 56 12.220	161.000	23	20 56 31.018	137.824
December 4			December 6		
h	h m s	° ' "	h	h m s	° ' "
0	18 58 53.220	160.654	0	20 58 48.842	137.295
1	19 01 33.874	160.297	1	21 01 06.137	136.768
2	19 04 14.171	159.932	2	21 03 22.905	136.243
3	19 06 54.103	159.556	3	21 05 39.148	135.720
4	19 09 33.659	159.173	4	21 07 54.868	135.199
5	19 12 12.832	158.780	5	21 10 10.067	134.680
6	19 14 51.612	158.379	6	21 12 24.747	134.163
7	19 17 29.991	157.969	7	21 14 38.910	133.650
8	19 20 07.960	157.553	8	21 16 52.560	133.138
9	19 22 45.513	157.127	9	21 19 05.698	132.631
10	19 25 22.640	156.695	10	21 21 18.329	132.124
11	19 27 59.335	156.254	11	21 23 30.453	131.623
12	19 30 35.589	155.809	12	21 25 42.076	131.123
13	19 33 11.398	155.355	13	21 27 53.199	130.628
14	19 35 46.753	154.895	14	21 30 03.827	130.135
15	19 38 21.648	154.429	15	21 32 13.962	129.646
16	19 40 56.077	153.958	16	21 34 23.608	129.161
17	19 43 30.035	153.481	17	21 36 32.769	128.680
18	19 46 03.516	152.998	18	21 38 41.449	128.201
19	19 48 36.514	152.510	19	21 40 49.650	127.728
20	19 51 09.024	152.018	20	21 42 57.378	127.258
21	19 53 41.042	151.521	21	21 45 04.636	126.792
22	19 56 12.563	151.020	22	21 47 11.428	126.330
23	19 58 43.583	150.515	23	21 49 17.758	125.872
24	20 01 14.098	150.005	24	21 51 23.630	125.419

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 7			December 9		
h	h m s	° ' "	h	h m s	° ' "
0	21 51 23.630	-17 51 58.87	0	23 24 41.635	-7 14 22.42
1	21 53 29.050	17 39 48.40	1	23 26 31.103	7 00 21.65
2	21 55 34.020	17 27 33.96	2	23 28 20.366	6 46 20.04
3	21 57 38.546	17 15 15.61	3	23 30 09.430	6 32 17.63
4	21 59 42.633	17 02 53.45	4	23 31 58.299	6 18 14.47
5	22 01 46.283	16 50 27.56	5	23 33 46.978	6 04 10.61
6	22 03 49.503	16 37 58.03	6	23 35 35.473	5 50 06.10
7	22 05 52.296	16 25 24.93	7	23 37 23.789	5 36 00.99
8	22 07 54.668	16 12 48.35	8	23 39 11.932	5 21 55.31
9	22 09 56.623	16 00 08.36	9	23 40 59.905	5 07 49.12
10	22 11 58.167	15 47 25.04	10	23 42 47.715	4 53 42.47
11	22 13 59.303	15 34 38.47	11	23 44 35.366	4 39 35.39
12	22 16 00.036	15 21 48.73	12	23 46 22.863	4 25 27.94
13	22 18 00.373	15 08 55.90	13	23 48 10.213	4 11 20.15
14	22 20 00.317	14 56 00.04	14	23 49 57.419	3 57 12.07
15	22 21 59.873	14 43 01.23	15	23 51 44.486	3 43 03.76
16	22 23 59.047	14 29 59.55	16	23 53 31.421	3 28 55.23
17	22 25 57.844	14 16 55.06	17	23 55 18.227	3 14 46.56
18	22 27 56.268	14 03 47.85	18	23 57 04.910	3 00 37.76
19	22 29 54.325	13 50 37.97	19	23 58 51.475	2 46 28.90
20	22 31 52.020	13 37 25.50	20	0 00 37.926	2 32 20.00
21	22 33 49.358	13 24 10.51	21	0 02 24.270	2 18 11.12
22	22 35 46.344	13 10 53.07	22	0 04 10.510	2 04 02.29
23	22 37 42.984	-12 57 33.24	23	0 05 56.652	-1 49 53.56
	116.298	+802.15		106.049	+848.59
December 8			December 10		
0	22 39 39.282	-12 44 11.09	0	0 07 42.701	-1 35 44.97
1	22 41 35.243	12 30 46.68	1	0 09 28.661	1 21 36.55
2	22 43 30.874	12 17 20.08	2	0 11 14.538	1 07 28.36
3	22 45 26.179	12 03 51.36	3	0 13 00.336	0 53 20.42
4	22 47 21.163	11 50 20.57	4	0 14 46.060	0 39 12.78
5	22 49 15.832	11 36 47.78	5	0 16 31.715	0 25 05.49
6	22 51 10.191	11 23 13.05	6	0 18 17.307	-0 10 58.58
7	22 53 04.245	11 09 36.44	7	0 20 02.839	+0 03 07.91
8	22 54 58.000	10 55 58.02	8	0 21 48.316	0 17 13.94
9	22 56 51.460	10 42 17.83	9	0 23 33.744	0 31 19.47
10	22 58 44.631	10 28 35.95	10	0 25 19.128	0 45 24.46
11	23 00 37.519	10 14 52.42	11	0 27 04.471	0 59 28.87
12	23 02 30.128	10 01 07.31	12	0 28 49.779	1 13 32.65
13	23 04 22.464	9 47 20.67	13	0 30 35.057	1 27 35.78
14	23 06 14.532	9 33 32.56	14	0 32 20.308	1 41 38.21
15	23 08 06.337	9 19 43.04	15	0 34 05.539	1 55 39.90
16	23 09 57.885	9 05 52.15	16	0 35 50.753	2 09 40.82
17	23 11 49.181	8 51 59.95	17	0 37 35.956	2 23 40.91
18	23 13 40.230	8 38 06.51	18	0 39 21.151	2 37 40.15
19	23 15 31.037	8 24 11.86	19	0 41 06.344	2 51 38.50
20	23 17 21.609	8 10 16.06	20	0 42 51.540	3 05 35.91
21	23 19 11.949	7 56 19.17	21	0 44 36.742	3 19 32.35
22	23 21 02.063	7 42 21.23	22	0 46 21.956	3 33 27.78
23	23 22 51.957	7 28 22.30	23	0 48 07.186	3 47 22.15
24	23 24 41.635	-7 14 22.42	24	0 49 52.436	+4 01 15.44
	109.678	+839.88		105.250	+833.29

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 11			December 13		
h	h m s	° ' " s	h	h m s	° ' " s
0	0 49 52.436	105° 276	0	2 15 54.125	111° 493
1	0 51 37.712	105° 305	1	2 17 45.618	111° 716
2	0 53 23.017	105° 340	2	2 19 37.334	111° 945
3	0 55 08.357	105° 379	3	2 21 29.279	112° 176
4	0 56 53.736	105° 421	4	2 23 21.455	112° 410
5	0 58 39.157	105° 470	5	2 25 13.865	112° 648
6	1 00 24.627	105° 522	6	2 27 06.513	112° 889
7	1 02 10.149	105° 579	7	2 28 59.402	113° 133
8	1 03 55.728	105° 639	8	2 30 52.535	113° 381
9	1 05 41.367	105° 706	9	2 32 45.916	113° 630
10	1 07 27.073	105° 775	10	2 34 39.546	113° 884
11	1 09 12.848	105° 849	11	2 36 33.430	114° 141
12	1 10 58.697	105° 929	12	2 38 27.571	114° 399
13	1 12 44.626	106° 011	13	2 40 21.970	114° 662
14	1 14 30.637	106° 099	14	2 42 16.632	114° 927
15	1 16 16.736	106° 190	15	2 44 11.559	115° 194
16	1 18 02.926	106° 286	16	2 46 06.753	115° 465
17	1 19 49.212	106° 387	17	2 48 02.218	115° 738
18	1 21 35.599	106° 491	18	2 49 57.956	116° 014
19	1 23 22.090	106° 600	19	2 51 53.970	116° 292
20	1 25 08.690	106° 712	20	2 53 50.262	116° 573
21	1 26 55.402	106° 830	21	2 55 46.835	116° 856
22	1 28 42.232	106° 951	22	2 57 43.691	117° 141
23	1 30 29.183	107° 077	23	2 59 40.832	117° 429
December 12			December 14		
h	h m s	° ' " s	h	h m s	° ' " s
0	1 32 16.260	107° 206	0	3 01 38.261	117° 720
1	1 34 03.466	107° 340	1	3 03 35.981	118° 011
2	1 35 50.806	107° 478	2	3 05 33.992	118° 306
3	1 37 38.284	107° 619	3	3 07 32.298	118° 602
4	1 39 25.903	107° 766	4	3 09 30.900	118° 900
5	1 41 13.669	107° 915	5	3 11 29.800	119° 201
6	1 43 01.584	108° 069	6	3 13 29.001	119° 502
7	1 44 49.653	108° 228	7	3 15 28.503	119° 806
8	1 46 37.881	108° 389	8	3 17 28.309	120° 112
9	1 48 26.270	108° 554	9	3 19 28.421	120° 418
10	1 50 14.824	108° 725	10	3 21 28.839	120° 727
11	1 52 03.549	108° 898	11	3 23 29.566	121° 036
12	1 53 52.447	109° 075	12	3 25 30.602	121° 348
13	1 55 41.522	109° 257	13	3 27 31.950	121° 660
14	1 57 30.779	109° 441	14	3 29 33.610	121° 973
15	1 59 20.220	109° 630	15	3 31 35.583	122° 288
16	2 01 09.850	109° 823	16	3 33 37.871	122° 604
17	2 02 59.673	110° 018	17	3 35 40.475	122° 919
18	2 04 49.691	110° 219	18	3 37 43.394	123° 237
19	2 06 39.910	110° 422	19	3 39 46.631	123° 555
20	2 08 30.332	110° 629	20	3 41 50.186	123° 873
21	2 10 20.961	110° 839	21	3 43 54.059	124° 192
22	2 12 11.800	111° 054	22	3 45 58.251	124° 512
23	2 14 02.854	111° 271	23	3 48 02.763	124° 831
24	2 15 54.125		24	3 50 07.594	

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination		
December 15							December 17						
h	h	m	s	°	'	"	h	h	m	s	°	'	"
0	3 50	07.594	^s 125.150	+22	59	54.76	0	5 35	52.991	^s 138.485	+27	39	08.50
1	3 52	12.744	^s 125.471	23	08	25.82	1	5 38	11.476	^s 138.673	27	41	47.16
2	3 54	18.215	^s 125.790	23	16	50.90	2	5 40	30.149	^s 138.856	27	44	17.28
3	3 56	24.005	^s 126.110	23	25	09.94	3	5 42	49.005	^s 139.034	27	46	38.79
4	3 58	30.115	^s 126.430	23	33	22.86	4	5 45	08.039	^s 139.206	27	48	51.68
5	4 00	36.545	^s 126.749	23	41	29.61	5	5 47	27.245	^s 139.371	27	50	55.91
6	4 02	43.294	^s 127.067	23	49	30.14	6	5 49	46.616	^s 139.532	27	52	51.43
7	4 04	50.361	^s 127.385	23	57	24.36	7	5 52	06.148	^s 139.687	27	54	38.23
8	4 06	57.746	^s 127.703	24	05	12.24	8	5 54	25.835	^s 139.835	27	56	16.27
9	4 09	05.449	^s 128.020	24	12	53.70	9	5 56	45.670	^s 139.978	27	57	45.52
10	4 11	13.469	^s 128.335	24	20	28.68	10	5 59	05.648	^s 140.114	27	59	05.95
11	4 13	21.804	^s 128.650	24	27	57.13	11	6 01	25.762	^s 140.245	28	00	17.54
12	4 15	30.454	^s 128.963	24	35	18.98	12	6 03	46.007	^s 140.370	28	01	20.25
13	4 17	39.417	^s 129.276	24	42	34.17	13	6 06	06.377	^s 140.487	28	02	14.06
14	4 19	48.693	^s 129.587	24	49	42.65	14	6 08	26.864	^s 140.600	28	02	58.96
15	4 21	58.280	^s 129.896	24	56	44.35	15	6 10	47.464	^s 140.706	28	03	34.91
16	4 24	08.176	^s 130.204	25	03	39.21	16	6 13	08.170	^s 140.805	28	04	01.90
17	4 26	18.380	^s 130.510	25	10	27.17	17	6 15	28.975	^s 140.898	28	04	19.90
18	4 28	28.890	^s 130.814	25	17	08.17	18	6 17	49.873	^s 140.985	28	04	28.91
19	4 30	39.704	^s 131.117	25	23	42.17	19	6 20	10.858	^s 141.065	28	04	28.89
20	4 32	50.821	^s 131.416	25	30	09.08	20	6 22	31.923	^s 141.140	28	04	19.83
21	4 35	02.237	^s 131.715	25	36	28.87	21	6 24	53.063	^s 141.206	28	04	01.73
22	4 37	13.952	^s 132.010	25	42	41.47	22	6 27	14.269	^s 141.268	28	03	34.56
23	4 39	25.962	^s 132.304	+25	48	46.82	23	6 29	35.537	^s 141.322	+28	02	58.31
December 16							December 18						
0	4 41	38.266	^s 132.594	+25	54	44.86	0	6 31	56.859	^s 141.370	+28	02	12.98
1	4 43	50.860	^s 132.881	26	00	35.55	1	6 34	18.229	^s 141.412	28	01	18.56
2	4 46	03.741	^s 133.167	26	06	18.82	2	6 36	39.641	^s 141.446	28	00	15.02
3	4 48	16.908	^s 133.449	26	11	54.61	3	6 39	01.087	^s 141.475	27	59	02.38
4	4 50	30.357	^s 133.728	26	17	22.88	4	6 41	22.562	^s 141.498	27	57	40.62
5	4 52	44.085	^s 134.004	26	22	43.57	5	6 43	44.060	^s 141.513	27	56	09.75
6	4 54	58.089	^s 134.277	26	27	56.62	6	6 46	05.573	^s 141.522	27	54	29.75
7	4 57	12.366	^s 134.545	26	33	01.99	7	6 48	27.095	^s 141.525	27	52	40.63
8	4 59	26.911	^s 134.811	26	37	59.61	8	6 50	48.620	^s 141.521	27	50	42.38
9	5 01	41.722	^s 135.073	26	42	49.44	9	6 53	10.141	^s 141.511	27	48	35.01
10	5 03	56.795	^s 135.331	26	47	31.42	10	6 55	31.652	^s 141.495	27	46	18.53
11	5 06	12.126	^s 135.585	26	52	05.51	11	6 57	53.147	^s 141.472	27	43	52.93
12	5 08	27.711	^s 135.836	26	56	31.66	12	7 00	14.619	^s 141.443	27	41	18.22
13	5 10	43.547	^s 136.081	27	00	49.80	13	7 02	36.062	^s 141.408	27	38	34.41
14	5 12	59.628	^s 136.323	27	04	59.91	14	7 04	57.470	^s 141.367	27	35	41.50
15	5 15	15.951	^s 136.561	27	09	01.92	15	7 07	18.837	^s 141.320	27	32	39.51
16	5 17	32.512	^s 136.794	27	12	55.80	16	7 09	40.157	^s 141.266	27	29	28.45
17	5 19	49.306	^s 137.022	27	16	41.49	17	7 12	01.423	^s 141.207	27	26	08.33
18	5 22	06.328	^s 137.246	27	20	18.95	18	7 14	22.630	^s 141.142	27	22	39.16
19	5 24	23.574	^s 137.465	27	23	48.14	19	7 16	43.772	^s 141.070	27	19	00.96
20	5 26	41.039	^s 137.679	27	27	09.01	20	7 19	04.842	^s 140.993	27	15	13.74
21	5 28	58.718	^s 137.889	27	30	21.53	21	7 21	25.835	^s 140.911	27	11	17.53
22	5 31	16.607	^s 138.092	27	33	25.64	22	7 23	46.746	^s 140.823	27	07	12.33
23	5 33	34.699	^s 138.292	27	36	21.31	23	7 26	07.569	^s 140.729	27	02	58.18
24	5 35	52.991	^s 138.485	+27	39	08.50	24	7 28	28.298	^s 140.629	+26	58	35.09

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension			Apparent Declination			Hour	Apparent Right Ascension			Apparent Declination					
December 19							December 21									
^h 0	^h 7	^m 28	^s 28.298		[°] +26	['] 58	^h 0	^h 9	^m 17	^s 50.580		[°] +20	['] 44	^s 24.05		
1	7	30	48.927	140.629		26 54 03.08	-272.01	1	9	20	02.191	131.611	20	33	30.63	
2	7	33	09.452	140.525		26 49 22.19	280.89	2	9	22	13.576	131.385	20	22	30.55	
3	7	35	29.866	140.414		26 44 32.42	289.77	3	9	24	24.735	131.159	20	11	23.88	
4	7	37	50.166	140.300		26 39 33.82	298.60	4	9	26	35.669	130.934	20	00	10.66	
5	7	40	10.346	140.180		26 34 26.40	307.42	5	9	28	46.380	130.711	19	48	50.97	
6	7	42	30.400	140.054		26 29 10.20	316.20	6	9	30	56.867	130.487	19	37	24.87	
7	7	44	50.324	139.924		26 23 45.24	324.96	7	9	33	07.131	130.264	19	25	52.42	
8	7	47	10.113	139.789		26 18 11.56	333.68	8	9	35	17.175	130.044	19	14	13.68	
9	7	49	29.762	139.649		26 12 29.19	342.37	9	9	37	26.998	129.823	19	02	28.71	
10	7	51	49.268	139.506		26 06 38.16	351.03	10	9	39	36.603	129.605	18	50	37.58	
11	7	54	08.624	139.356		26 00 38.50	359.66	11	9	41	45.991	129.388	18	38	40.36	
12	7	56	27.828	139.204		25 54 30.26	368.24	12	9	43	55.162	129.171	18	26	37.10	
13	7	58	46.874	139.046		25 48 13.46	376.80	13	9	46	04.120	128.958	18	14	27.87	
14	8	01	05.759	138.885		25 41 48.14	385.32	14	9	48	12.865	128.745	18	02	12.73	
15	8	03	24.478	138.719		25 35 14.35	393.79	15	9	50	21.399	128.534	17	49	51.75	
16	8	05	43.029	138.551		25 28 32.12	402.23	16	9	52	29.724	128.325	17	37	24.99	
17	8	08	01.406	138.377		25 21 41.49	410.63	17	9	54	37.843	128.119	17	24	52.52	
18	8	10	19.606	138.200		25 14 42.50	418.99	18	9	56	45.756	127.913	17	12	14.41	
19	8	12	37.626	138.020		25 07 35.20	427.30	19	9	58	53.468	127.712	16	59	30.71	
20	8	14	55.463	137.837		25 00 19.63	435.57	20	10	01	00.979	127.511	16	46	41.49	
21	8	17	13.113	137.650		24 52 55.82	443.81	21	10	03	08.292	127.313	16	33	46.82	
22	8	19	30.572	137.459		24 45 23.84	451.98	22	10	05	15.409	127.117	16	20	46.76	
23	8	21	47.839	137.267		+24 37 43.71	460.13	23	10	07	22.334	126.925	+16	07	41.38	
				137.071			-468.21					126.734			-790.64	
December 20							December 22									
0	8	24	04.910		+24	29	55.50	-476.26	0	10	09	29.068		+15	54	30.74
1	8	26	21.782	136.872		24 21 59.24	484.26	1	10	11	35.615	126.547		15	41	14.91
2	8	28	38.452	136.670		24 13 54.98	492.20	2	10	13	41.977	126.362		15	27	53.96
3	8	30	54.919	136.467		24 05 42.78	500.10	3	10	15	48.157	126.180		15	14	27.95
4	8	33	11.180	136.261		23 57 22.68	507.95	4	10	17	54.159	126.002		15	00	56.94
5	8	35	27.232	136.052		23 48 54.73	515.75	5	10	19	59.984	125.825		14	47	21.01
6	8	37	43.074	135.842		23 40 18.98	523.49	6	10	22	05.637	125.653		14	33	40.22
7	8	39	58.703	135.629		23 31 35.49	531.18	7	10	24	11.120	125.483		14	19	54.64
8	8	42	14.117	135.414		23 22 44.31	538.83	8	10	26	16.436	125.316		14	06	04.33
9	8	44	29.316	135.199		23 13 45.48	546.41	9	10	28	21.590	125.154		13	52	09.36
10	8	46	44.297	134.981		23 04 39.07	553.94	10	10	30	26.584	124.994		13	38	09.79
11	8	48	59.059	134.762		22 55 25.13	561.42	11	10	32	31.422	124.838		13	24	05.69
12	8	51	13.600	134.541		22 46 03.71	568.84	12	10	34	36.108	124.686		13	09	57.14
13	8	53	27.919	134.319		22 36 34.87	576.21	13	10	36	40.644	124.536		12	55	44.19
14	8	55	42.016	134.097		22 26 58.66	583.52	14	10	38	45.036	124.392		12	41	26.92
15	8	57	55.888	133.872		22 17 15.14	590.77	15	10	40	49.285	124.249		12	27	05.38
16	9	00	09.537	133.649		22 07 24.37	597.97	16	10	42	53.398	124.113		12	12	39.66
17	9	02	22.960	133.423		21 57 26.40	605.11	17	10	44	57.376	123.978		11	58	09.81
18	9	04	36.157	133.197		21 47 21.29	612.18	18	10	47	01.224	123.848		11	43	35.90
19	9	06	49.127	132.970		21 37 09.11	619.21	19	10	49	04.946	123.722		11	28	58.00
20	9	09	01.872	132.745		21 26 49.90	626.17	20	10	51	08.547	123.601		11	14	16.17
21	9	11	14.389	132.517		21 16 23.73	633.07	21	10	53	12.030	123.483		10	59	30.50
22	9	13	26.680	132.291		21 05 50.66	639.91	22	10	55	15.399	123.369		10	44	41.03
23	9	15	38.743	132.063		20 55 10.75	646.70	23	10	57	18.658	123.259		10	29	47.85
24	9	17	50.580	131.837		+20 44 24.05		24	10	59	21.813	123.155		+10	14	51.02

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 23			December 25		
0	10 59 21-813	-10 14 51-02	0	12 37 23-695	-2 31 12-34
1	11 01 24-867	9 59 50-60	1	12 39 27-964	2 47 40-54
2	11 03 27-824	9 44 46-67	2	12 41 32-187	3 04 08-69
3	11 05 30-689	9 29 39-29	3	12 43 36-570	3 20 36-70
4	11 07 33-467	9 14 26-34	4	12 45 41-118	3 37 04-48
5	11 09 36-161	8 59 14-47	5	12 47 45-839	3 53 31-96
6	11 11 38-778	8 43 57-17	6	12 49 50-736	4 09 59-03
7	11 13 41-320	8 28 36-69	7	12 51 55-816	4 26 25-62
8	11 15 43-793	8 13 13-11	8	12 54 01-086	4 42 51-65
9	11 17 46-202	7 57 46-50	9	12 56 06-549	4 59 17-01
10	11 19 48-550	7 42 16-93	10	12 58 12-213	5 15 41-62
11	11 21 50-844	7 26 44-46	11	13 00 18-082	5 32 05-40
12	11 23 53-088	7 11 09-16	12	13 02 24-163	5 48 28-25
13	11 25 55-286	6 55 31-12	13	13 04 30-460	6 04 50-98
14	11 27 57-444	6 39 50-39	14	13 06 36-981	6 21 10-80
15	11 29 59-566	6 24 07-04	15	13 08 43-730	6 37 30-32
16	11 32 01-658	6 08 21-16	16	13 10 50-713	6 53 48-55
17	11 34 03-725	5 52 32-80	17	13 12 57-935	7 10 05-39
18	11 36 05-771	5 36 42-04	18	13 15 05-403	7 26 20-75
19	11 38 07-801	5 20 48-95	19	13 17 13-121	7 42 34-53
20	11 40 09-822	5 04 53-60	20	13 19 21-096	7 58 46-65
21	11 42 11-837	4 48 56-07	21	13 21 29-333	8 14 56-99
22	11 44 13-853	4 32 56-42	22	13 23 37-837	8 31 05-47
23	11 46 15-873	4 16 54-73	23	13 25 46-613	8 47 11-99
December 24			December 26		
0	11 48 17-905	4 00 51-08	0	13 27 53-668	9 03 16-45
1	11 50 19-952	3 44 45-52	1	13 30 03-007	9 19 18-74
2	11 52 22-021	3 28 38-15	2	13 32 14-633	9 35 18-78
3	11 54 24-115	3 12 29-02	3	13 34 24-536	9 51 16-46
4	11 56 26-242	2 56 18-22	4	13 36 34-778	10 07 11-68
5	11 58 28-406	2 40 05-12	5	13 38 45-304	10 23 04-33
6	12 00 30-612	2 23 51-59	6	13 40 56-141	10 38 54-32
7	12 02 32-867	2 07 36-52	7	13 43 07-292	10 54 41-54
8	12 04 35-175	1 51 19-76	8	13 45 18-764	11 10 25-58
9	12 06 37-542	1 35 01-71	9	13 47 30-561	11 26 07-25
10	12 08 39-973	1 18 42-43	10	13 49 42-689	11 41 45-53
11	12 10 42-474	1 02 22-06	11	13 51 55-851	11 57 20-62
12	12 12 45-051	0 46 00-51	12	13 54 07-954	12 12 52-41
13	12 14 47-709	0 29 38-02	13	13 56 21-102	12 28 20-80
14	12 16 50-453	0 13 14-61	14	13 58 34-599	12 43 45-67
15	12 18 53-290	0 03 09-63	15	14 00 48-451	12 59 06-92
16	12 20 56-224	0 19 34-63	16	14 03 02-661	13 14 24-44
17	12 22 59-262	0 36 00-31	17	14 05 17-235	13 29 38-11
18	12 25 02-409	0 52 26-59	18	14 07 32-177	13 44 47-83
19	12 27 05-670	1 08 53-39	19	14 09 47-491	13 59 53-48
20	12 29 09-052	1 25 20-63	20	14 12 03-181	14 14 54-95
21	12 31 12-560	1 41 48-22	21	14 14 19-253	14 29 52-12
22	12 33 16-199	1 58 16-09	22	14 16 35-707	14 44 44-89
23	12 35 19-976	2 14 44-16	23	14 18 52-551	14 59 33-14
24	12 37 23-695	2 31 12-34	24	14 21 09-787	15 14 16-75

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension	Apparent Declination	Hour	Apparent Right Ascension	Apparent Declination
December 27			December 29		
^h 0	^h 14 ^m 21 ^s 09.787 ^s	[°] -15 ['] 14 ["] 16.75 ["]	^h 0	^h 16 ^m 19 ^s 16.895 ^s	[°] -24 ['] 51 ["] 16.37 ["]
1	14 23 27.419 137.632	15 28 55.60 878.85	1	16 21 54.753 157.858	24 59 46.78 510.41
2	14 25 45.451 138.032	15 43 29.59 873.99	2	16 24 32.970 158.217	25 08 06.73 499.95
3	14 28 03.887 138.436	15 57 58.59 869.00	3	16 27 11.539 158.569	25 16 16.12 489.39
4	14 30 22.729 138.842	16 12 22.49 863.90	4	16 29 50.455 158.916	25 24 14.85 478.73
5	14 32 41.981 139.252	16 26 41.16 858.67	5	16 32 29.708 159.253	25 32 02.83 467.98
6	14 35 01.646 139.665	16 40 54.50 853.34	6	16 35 09.293 159.585	25 39 39.98 457.15
7	14 37 21.727 140.081	16 55 02.38 847.88	7	16 37 49.200 159.907	25 47 06.19 446.21
8	14 39 42.227 140.500	17 09 04.68 842.30	8	16 40 29.423 160.223	25 54 21.40 435.21
9	14 42 03.148 140.921	17 23 01.28 836.60	9	16 43 09.952 160.529	25 54 21.40 424.10
10	14 44 24.494 141.346	17 36 52.06 830.78	10	16 45 50.780 160.828	26 01 25.50 412.92
11	14 46 46.267 141.773	17 50 36.91 824.85	11	16 48 31.897 161.117	26 08 18.42 401.66
12	14 49 08.468 142.201	18 04 15.70 818.79	12	16 51 13.294 161.397	26 15 00.08 390.32
13	14 51 31.100 142.632	18 17 48.30 812.60	13	16 53 54.963 161.669	26 21 30.40 378.90
14	14 53 54.166 143.066	18 31 14.61 806.31	14	16 56 36.893 161.930	26 27 49.30 367.42
15	14 56 17.666 143.500	18 44 34.49 799.88	15	16 59 19.075 162.182	26 33 56.72 355.86
16	14 58 41.602 143.936	18 57 47.83 793.34	16	17 02 01.500 162.425	26 39 52.58 344.23
17	15 01 05.976 144.374	19 10 54.50 786.67	17	17 04 44.155 162.655	26 45 36.81 332.55
18	15 03 30.790 144.814	19 23 54.39 779.89	18	17 07 27.033 162.878	26 51 09.36 320.79
19	15 05 56.043 145.253	19 36 47.36 772.97	19	17 10 10.120 163.087	26 56 30.15 308.98
20	15 08 21.737 145.694	19 49 33.30 765.94	20	17 12 53.408 163.288	27 01 39.13 297.11
21	15 10 47.873 146.136	19 62 12.08 758.78	21	17 15 36.885 163.477	27 06 36.24 285.19
22	15 13 14.451 146.578	20 02 12.08 751.50	22	17 18 20.539 163.654	27 11 21.43 273.22
23	15 15 41.472 147.021	20 14 43.58 744.11	23	17 21 04.360 163.821	27 15 54.65 261.19
	147.463	-20 27 07.69 -736.58		163.976	-27 20 15.84 -249.13
December 28			December 30		
0	15 18 08.935 147.905	-20 39 24.27 -728.94	0	17 23 48.336 164.120	-27 24 24.97 -237.02
1	15 20 36.840 148.347	20 51 33.21 721.18	1	17 26 32.456 164.251	27 28 21.99 224.88
2	15 23 05.187 148.789	21 03 34.39 713.29	2	17 29 16.707 164.370	27 32 06.87 212.69
3	15 25 33.976 149.229	21 15 27.68 705.28	3	17 32 01.077 164.478	27 35 39.56 200.47
4	15 28 03.205 149.668	21 27 12.96 697.16	4	17 34 45.555 164.573	27 39 00.03 188.23
5	15 30 32.873 150.107	21 38 50.12 688.91	5	17 37 30.128 164.657	27 42 08.26 175.97
6	15 33 02.980 150.543	21 50 19.03 680.54	6	17 40 14.785 164.726	27 45 04.23 163.66
7	15 35 33.523 150.978	22 01 39.57 672.06	7	17 42 59.511 164.785	27 47 47.89 151.36
8	15 38 04.501 151.411	22 12 51.63 663.45	8	17 45 44.296 164.830	27 50 19.25 139.02
9	15 40 35.912 151.842	22 23 55.08 654.72	9	17 48 29.126 164.863	27 52 38.27 126.68
10	15 43 07.754 152.270	22 34 49.80 645.89	10	17 51 13.989 164.883	27 54 44.95 114.33
11	15 45 40.024 152.696	22 45 35.69 636.94	11	17 53 58.872 164.890	27 56 39.28 101.96
12	15 48 12.720 153.118	22 56 12.63 627.86	12	17 56 43.762 164.885	27 58 21.24 89.61
13	15 50 45.838 153.537	23 06 40.49 618.68	13	17 59 28.647 164.867	27 59 50.85 77.23
14	15 53 19.375 153.952	23 16 59.17 609.38	14	18 02 13.514 164.835	28 01 08.08 64.88
15	15 55 53.327 154.365	23 27 08.55 599.97	15	18 04 58.349 164.791	28 02 12.96 52.52
16	15 58 27.692 154.772	23 37 08.52 590.45	16	18 07 43.140 164.735	28 03 05.48 40.18
17	16 01 02.464 155.176	23 46 58.97 580.81	17	18 10 27.875 164.665	28 03 45.66 27.85
18	16 03 37.640 155.575	23 56 39.78 571.07	18	18 13 12.540 164.582	28 04 13.51 15.53
19	16 06 13.215 155.969	24 06 10.85 561.23	19	18 15 57.122 164.487	28 04 29.04 3.23
20	16 08 49.184 156.358	24 15 32.08 551.26	20	18 18 41.609 164.379	28 04 32.27 9.03
21	16 11 25.542 156.742	24 24 43.34 541.21	21	18 21 25.988 164.258	28 04 23.24 21.29
22	16 14 02.284 157.120	24 33 44.55 531.04	22	18 24 10.246 164.125	28 04 01.95 33.51
23	16 16 39.404 157.491	24 42 35.59 520.78	23	18 26 54.371 163.980	28 03 28.44 45.69
24	16 19 16.895	-24 51 16.37	24	18 29 38.351	-28 02 42.75

FOR EACH HOUR OF EPHEMERIS TIME

Hour	Apparent Right Ascension				Apparent Declination				Hour	Apparent Right Ascension				Apparent Declination			
December 31									December 31								
^h	^h	^m	^s		[°]	[']	[″]		^h	^h	^m	^s		[°]	[']	[″]	
0	18	29	38.351	^s 163.821	-28	02	42.75	[″] + 57.84	12	19	02	10.333	^s 161.001	-27	37	59.67	[″] + 199.85
1	18	32	22.172	163.650	28	01	44.91	69.96	13	19	04	51.334	160.693	27	34	39.82	211.27
2	18	35	05.822	163.468	28	00	34.95	82.03	14	19	07	32.027	160.376	27	31	08.55	222.63
3	18	37	49.290	163.273	27	59	12.92	94.06	15	19	10	12.403	160.049	27	27	25.92	233.91
4	18	40	32.563	163.067	27	57	38.86	106.04	16	19	12	52.452	159.711	27	23	32.01	245.11
5	18	43	15.630	162.848	27	55	52.82	117.97	17	19	15	32.163	159.366	27	19	26.90	256.24
6	18	45	58.478	162.617	27	53	54.85	129.84	18	19	18	11.529	159.009	27	15	10.66	267.27
7	18	48	41.095	162.376	27	51	45.01	141.67	19	19	20	50.538	158.644	27	10	43.39	278.22
8	18	51	23.471	162.123	27	49	23.34	153.43	20	19	23	29.182	158.271	27	06	05.17	289.09
9	18	54	05.594	161.859	27	46	49.91	165.13	21	19	26	07.453	157.888	27	01	16.08	299.87
10	18	56	47.453	161.583	27	44	04.78	176.77	22	19	28	45.341	157.497	26	56	16.21	310.55
11	18	59	29.036	161.297	27	41	08.01	+188.34	23	19	31	22.838	157.099	26	51	05.66	+321.15
12	19	02	10.333		-27	37	59.67		24	19	33	59.937		-26	45	44.51	

PHASES OF THE MOON

Lunation	New Moon			First Quarter			Full Moon			Last Quarter		
	d	h	m	d	h	m	d	h	m	d	h	m
544	Dec.	12	03 14	Dec.	19	21 41	Dec.	27	17 44	Jan.	3	14 19
545	Jan.	10	18 06	Jan.	18	19 42	Jan.	26	06 41	Feb.	1	23 03
546	Feb.	9	10 44	Feb.	17	15 57	Feb.	24	17 44	Mar.	3	09 11
547	Mar.	11	04 30	Mar.	19	08 32	Mar.	26	03 21	Apr.	1	20 59
548	Apr.	9	22 21	Apr.	17	20 48	Apr.	24	12 04	May	1	10 33
549	May	9	14 56	May	17	05 18	May	23	20 23	May	31	01 52
550	June	8	05 14	June	15	11 12	June	22	04 57	June	29	18 40
551	July	7	17 01	July	14	15 53	July	21	14 40	July	29	12 15
552	Aug.	6	02 49	Aug.	12	20 45	Aug.	20	02 27	Aug.	28	05 35
553	Sept.	4	11 38	Sept.	11	03 06	Sept.	18	17 00	Sept.	26	21 44
554	Oct.	3	20 24	Oct.	10	12 11	Oct.	18	10 11	Oct.	26	12 04
555	Nov.	2	05 49	Nov.	9	01 00	Nov.	17	04 53	Nov.	25	00 24
556	Dec.	1	16 10	Dec.	8	17 58	Dec.	16	23 22	Dec.	24	10 48
557	Dec.	31	03 39	Jan.	7	14 23	Jan.	15	16 12	Jan.	22	19 38

PERIGEE

APOGEE

Jan.	d	h	May	d	h	Oct.	d	h	Jan.	d	h	June	d	h	Oct.	d	h
Jan.	1	10	May	22	02	Oct.	4	14	Jan.	16	21	June	3	02	Oct.	19	08
Jan.	28	15	June	18	20	Nov.	2	02	Feb.	13	15	June	30	20	Nov.	15	08
Feb.	25	21	July	14	20	Nov.	30	14	Mar.	13	01	July	28	14	Dec.	12	18
Mar.	26	08	Aug.	9	15	Dec.	28	19	Apr.	9	03	Aug.	25	09	Jan.	9	13
Apr.	23	19	Sept.	6	08				May	6	11	Sept.	22	00			

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Jan. 0	9490.5	245° 50' 24.9	-2° 09' 45.2	0.464 4959	245.96615	2.78148
1	9491.5	248 35 58.2	2 28 55.1	.465 4637	248.74157	2.76993
2	9492.5	251 21 00.9	2 47 40.3	.466 1532	251.50713	2.76173
3	9493.5	254 05 45.4	3 05 59.8	.466 5642	254.26615	2.75687
4	9494.5	256 50 24.1	3 23 52.5	.466 6959	257.02198	2.75533
5	9495.5	259 35 09.2	-3 41 17.2	0.466 5484	259.77790	2.75706
6	9496.5	262 20 12.8	3 58 12.8	.466 1215	262.53721	2.76212
7	9497.5	265 05 47.2	4 14 37.8	.465 4161	265.30324	2.77049
8	9498.5	267 52 04.6	4 30 30.9	.464 4329	268.07932	2.78224
9	9499.5	270 39 17.6	4 45 50.5	.463 1727	270.86886	2.79741
10	9500.5	273 27 38.7	-5 00 34.8	0.461 6374	273.67530	2.81604
11	9501.5	276 17 20.8	5 14 42.1	.459 8288	276.50213	2.83824
12	9502.5	279 08 36.9	5 28 10.2	.457 7490	279.35299	2.86408
13	9503.5	282 01 40.5	5 40 56.8	.455 4004	282.23155	2.89369
14	9504.5	284 56 45.5	5 52 59.5	.452 7867	285.14168	2.92721
15	9505.5	287 54 06.0	-6 04 15.3	0.449 9118	288.08731	2.96473
16	9506.5	290 53 56.9	6 14 41.4	.446 7794	291.07254	3.00645
17	9507.5	293 56 33.4	6 24 14.2	.443 3948	294.10166	3.05253
18	9508.5	297 02 11.3	6 32 50.1	.439 7636	297.17911	3.10314
19	9509.5	300 11 07.0	6 40 24.9	.435 8923	300.30953	3.15850
20	9510.5	303 23 37.6	-6 46 54.1	0.431 7882	303.49777	3.21883
21	9511.5	306 40 00.9	6 52 13.0	.427 4599	306.74892	3.28435
22	9512.5	310 00 35.4	6 56 16.0	.422 9168	310.06827	3.35529
23	9513.5	313 25 40.3	6 58 57.4	.418 1695	313.46139	3.43191
24	9514.5	316 55 35.4	7 00 10.9	.413 2305	316.93405	3.51443
25	9515.5	320 30 41.2	-6 59 49.7	0.408 1134	320.49230	3.60311
26	9516.5	324 11 19.2	6 57 46.5	.402 8338	324.14240	3.69817
27	9517.5	327 57 50.9	6 53 53.7	.397 4089	327.89084	3.79982
28	9518.5	331 50 38.6	6 48 03.1	.391 8585	331.74430	3.90823
29	9519.5	335 50 04.9	6 40 06.4	.386 2044	335.70959	4.02350
30	9520.5	339 56 32.2	-6 29 54.9	0.380 4712	339.79360	4.14567
31	9521.5	344 10 22.8	6 17 20.0	.374 6858	344.00322	4.27469
Feb. 1	9522.5	348 31 58.3	6 02 13.3	.368 8785	348.34519	4.41034
2	9523.5	353 01 39.4	5 44 26.9	.363 0824	352.82599	4.55227
3	9524.5	357 39 44.8	5 23 53.8	.357 3338	357.45164	4.69991
4	9525.5	2 26 31.2	-5 00 28.3	0.351 6723	2.22745	4.85245
5	9526.5	7 22 11.9	4 34 06.8	.346 1409	7.15781	5.00878
6	9527.5	12 26 56.1	4 04 48.1	.340 7851	12.24579	5.16745
7	9528.5	17 40 48.2	3 32 34.3	.335 6534	17.49289	5.32666
8	9529.5	23 03 46.0	2 57 31.5	.330 7961	22.89857	5.48424
9	9530.5	28 35 40.2	-2 19 50.6	0.326 2656	28.45996	5.63760
10	9531.5	34 16 13.0	1 39 47.7	.322 1139	34.17140	5.78385
11	9532.5	40 04 57.3	0 57 44.7	.318 3923	40.02425	5.91985
12	9533.5	46 01 15.6	-0 14 09.2	.315 1503	46.00658	6.04227
13	9534.5	52 04 20.0	+0 30 25.3	.312 4334	52.10317	6.14782
14	9535.5	58 13 11.8	+1 15 20.9	0.310 2814	58.29556	6.23338
15	9536.5	64 26 42.4	+1 59 55.9	0.308 7277	64.56238	6.29629

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Feb. 15	9536.5	64° 26' 42.4"	+1° 59' 55.9"	0.308 7277	64.56238	6.29629
16	9537.5	70 43 34.5	2 43 26.4	.307 7967	70.87988	6.33444
17	9538.5	77 02 23.4	3 25 09.0	.307 5035	77.22256	6.34651
18	9539.5	83 21 40.1	4 04 22.0	.307 8528	83.56408	6.33213
19	9540.5	89 39 53.5	4 40 27.9	.308 8389	89.87815	6.29175
20	9541.5	95 55 33.8	+5 12 55.5	0.310 4460	96.13938	6.22677
21	9542.5	102 07 14.8	5 41 20.3	.312 6488	102.32421	6.13936
22	9543.5	108 13 37.5	6 05 26.0	.315 4133	108.41151	6.03220
23	9544.5	114 13 31.6	6 25 04.0	.318 6991	114.38308	5.90846
24	9545.5	120 05 57.1	6 40 13.2	.322 4601	120.22400	5.77144
25	9546.5	125 50 05.7	+6 50 59.4	0.326 6469	125.92263	5.62443
26	9547.5	131 25 20.4	6 57 33.4	.331 2081	131.47058	5.47058
27	9548.5	136 51 15.7	7 00 10.3	.336 0912	136.86248	5.31278
28	9549.5	142 07 36.4	6 59 08.3	.341 2445	142.09566	5.15354
Mar. 1	9550.5	147 14 16.7	6 54 46.9	.346 6175	147.16979	4.99500
2	9551.5	152 11 18.7	+6 47 26.7	0.352 1623	152.08649	4.83895
3	9552.5	156 58 51.4	6 37 28.1	.357 8331	156.84899	4.68680
4	9553.5	161 37 09.1	6 25 10.9	.363 5874	161.46175	4.53963
5	9554.5	166 06 30.2	6 10 53.6	.369 3859	165.93017	4.39823
6	9555.5	170 27 16.3	5 54 53.6	.375 1925	170.26031	4.26314
7	9556.5	174 39 50.9	+5 37 26.9	0.380 9744	174.45868	4.13472
8	9557.5	178 44 39.2	5 18 47.6	.386 7020	178.53204	4.01315
9	9558.5	182 42 06.7	4 59 08.5	.392 3479	182.48729	3.89849
10	9559.5	186 32 39.5	4 38 41.1	.397 8880	186.33130	3.79067
11	9560.5	190 16 43.2	4 17 35.1	.403 3007	190.07088	3.68961
12	9561.5	193 54 43.3	+3 55 59.5	0.408 5668	193.71271	3.59512
13	9562.5	197 27 04.4	3 34 01.7	.413 6690	197.26323	3.50697
14	9563.5	200 54 10.3	3 11 48.3	.418 5918	200.72870	3.42498
15	9564.5	204 16 24.1	2 49 25.1	.423 3216	204.11515	3.34888
16	9565.5	207 34 07.7	2 26 57.0	.427 8464	207.42834	3.27842
17	9566.5	210 47 42.2	+2 04 28.1	0.432 1555	210.67379	3.21336
18	9567.5	213 57 27.9	1 42 02.3	.436 2393	213.85678	3.15347
19	9568.5	217 03 44.0	1 19 42.5	.440 0898	216.98238	3.09854
20	9569.5	220 06 48.8	0 57 31.6	.443 6997	220.05543	3.04833
21	9570.5	223 07 00.0	0 35 31.9	.447 0625	223.08055	3.00264
22	9571.5	226 04 34.3	+0 13 45.4	0.450 1724	226.06216	2.96129
23	9572.5	228 59 47.8	-0 07 46.1	.453 0247	229.00453	2.92413
24	9573.5	231 52 56.0	0 29 01.0	.455 6152	231.91175	2.89098
25	9574.5	234 44 13.8	0 49 57.8	.457 9401	234.78777	2.86169
26	9575.5	237 33 55.5	1 10 35.4	.459 9966	237.63639	2.83617
27	9576.5	240 22 14.9	-1 30 52.5	0.461 7815	240.46132	2.81428
28	9577.5	243 09 25.6	1 50 48.0	.463 2929	243.26614	2.79594
29	9578.5	245 55 40.6	2 10 20.8	.464 5288	246.05437	2.78109
30	9579.5	248 41 12.9	2 29 30.0	.465 4878	248.82946	2.76965
31	9580.5	251 26 14.9	2 48 14.5	.466 1689	251.59479	2.76156
Apr. 1	9581.5	254 10 59.2	-3 06 33.2	0.466 5713	254.35369	2.75680
2	9582.5	256 55 38.0	-3 24 25.0	0.466 6945	257.10949	2.75535

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
Apr.	243 9581.5	254 10 59.2	-3 06 33.2	0.466 5713	254.35369	2.75680
	2 9582.5	256 55 38.0	3 24 25.0	.466 6945	257.10949	2.75535
	3 9583.5	259 40 23.5	3 41 48.9	.466 5385	259.86548	2.75719
	4 9584.5	262 25 27.9	3 58 43.5	.466 1030	262.62497	2.76234
	5 9585.5	265 11 03.5	4 15 07.6	.465 3891	265.39127	2.77082
	6 9586.5	267 57 22.5	-4 30 59.7	0.464 3974	268.16773	2.78267
	7 9587.5	270 44 37.4	4 46 18.2	.463 1288	270.95775	2.79794
	8 9588.5	273 33 00.9	5 01 01.5	.461 5850	273.76477	2.81668
	9 9589.5	276 22 45.7	5 15 07.6	.459 7681	276.59230	2.83899
	10 9590.5	279 14 04.9	5 28 34.4	.457 6799	279.44397	2.86496
	11 9591.5	282 07 12.1	-5 41 19.7	0.455 3234	282.32347	2.89468
	12 9592.5	285 02 21.1	5 53 21.0	.452 7017	285.23464	2.92832
	13 9593.5	287 59 46.1	6 04 35.4	.449 8188	288.18144	2.96596
	14 9594.5	290 59 41.9	6 14 59.8	.446 6788	291.16796	3.00781
	15 9595.5	294 02 23.7	6 24 31.0	.443 2866	294.19851	3.05402
	16 9596.5	297 08 07.5	-6 33 05.0	0.439 6480	297.27752	3.10478
	17 9597.5	300 17 09.6	6 40 37.9	.435 7696	300.40966	3.16030
	18 9598.5	303 29 47.1	6 47 05.1	.431 6586	303.59977	3.22077
	19 9599.5	306 46 17.9	6 52 21.6	.427 3236	306.85293	3.28644
	20 9600.5	310 07 00.4	6 56 22.2	.422 7741	310.17447	3.35756
	21 9601.5	313 32 13.9	-6 59 01.0	0.418 0210	313.56994	3.43434
	22 9602.5	317 02 18.2	7 00 11.7	.413 0764	317.04513	3.51705
	23 9603.5	320 37 33.9	6 59 47.5	.407 9544	320.60610	3.60593
	24 9604.5	324 18 22.4	6 57 41.1	.402 6700	324.25912	3.70119
	25 9605.5	328 05 05.3	6 53 44.7	.397 2411	328.01068	3.80304
	26 9606.5	331 58 04.9	-6 47 50.4	0.391 6873	331.86746	3.91166
	27 9607.5	335 57 43.7	6 39 49.7	.386 0305	335.83628	4.02713
	28 9608.5	340 04 24.2	6 29 33.9	.380 2952	339.92403	4.14952
	29 9609.5	344 18 28.7	6 16 54.4	.374 5088	344.13759	4.27873
	30 9610.5	348 40 18.7	6 01 42.9	.368 7015	348.48370	4.41457
May	1 9611.5	353 10 14.9	-5 43 51.5	0.362 9064	352.96883	4.55669
	2 9612.5	357 48 36.0	5 23 13.2	.357 1599	357.59898	4.70450
	3 9613.5	2 35 38.4	4 59 42.4	.351 5018	2.37945	4.85717
	4 9614.5	7 31 35.6	4 33 15.4	.345 9750	7.31457	5.01359
	5 9615.5	12 36 36.5	4 03 51.3	.340 6254	12.40739	5.17230
	6 9616.5	17 50 45.2	-3 31 32.2	0.335 5014	17.65933	5.33149
	7 9617.5	23 13 59.5	2 56 24.4	.330 6535	23.06981	5.48897
	8 9618.5	28 46 09.8	2 18 38.9	.326 1338	28.63585	5.64216
	9 9619.5	34 26 58.0	1 38 31.9	.321 9945	34.35173	5.78815
	10 9620.5	40 15 56.6	0 56 25.7	.318 2869	40.20870	5.92378
	11 9621.5	46 12 28.0	-0 12 47.9	0.315 0602	46.19473	6.04573
	12 9622.5	52 15 43.8	+0 31 47.9	.312 3601	52.29451	6.15073
	13 9623.5	58 24 45.1	1 16 43.4	.310 2259	58.48948	6.23563
	14 9624.5	64 38 23.0	2 01 17.0	.308 6909	64.75818	6.29780
	15 9625.5	70 55 19.7	2 44 44.9	.307 7790	71.07680	6.33517
	16 9626.5	77 14 10.8	+3 26 23.5	0.307 5053	77.41981	6.34645
	17 9627.5	83 33 26.8	+4 05 31.2	0.307 8742	83.76086	6.33126

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
243						
May	17 9627.5	83 33 26.8	+4 05 31.2	0.307 8742	83.76086	6.33126
	18 9628.5	89 51 36.8	4 41 31.0	.308 8796	90.07366	6.29010
	19 9629.5	96 07 10.9	5 13 51.4	.310 5052	96.33288	6.22441
	20 9630.5	102 18 43.4	5 42 08.5	.312 7255	102.51502	6.13634
	21 9631.5	108 24 55.1	6 06 06.1	.315 5065	108.59901	6.02863
	22 9632.5	114 24 36.3	+6 25 35.8	0.318 8074	114.56679	5.90444
	23 9633.5	120 16 47.2	6 40 36.9	.322 5821	120.40350	5.76707
	24 9634.5	126 00 40.0	6 51 15.1	.326 7812	126.09764	5.61982
	25 9635.5	131 35 37.9	6 57 41.6	.331 3530	131.64089	5.46581
	26 9636.5	137 01 15.9	7 00 11.6	.336 2450	137.02797	5.30793
	27 9637.5	142 17 18.9	+6 59 03.1	0.341 4057	142.25629	5.14867
	28 9638.5	147 23 41.4	6 54 36.0	.346 7845	147.32557	4.99018
	29 9639.5	152 20 25.9	6 47 10.7	.352 3336	152.23751	4.83425
	30 9640.5	157 07 41.4	6 37 07.5	.358 0075	156.99538	4.68224
	31 9641.5	161 45 42.4	6 24 46.3	.363 7637	161.60365	4.53521
June	1 9642.5	166 14 47.5	+6 10 25.6	0.369 5628	166.06775	4.39401
	2 9643.5	170 35 18.3	5 54 22.8	.375 3692	170.39378	4.25913
	3 9644.5	174 47 38.3	5 36 53.6	.381 1499	174.58824	4.13092
	4 9645.5	178 52 12.7	5 18 12.3	.386 8752	178.65790	4.00955
	5 9646.5	182 49 27.2	4 58 31.5	.392 5181	182.60965	3.89510
	6 9647.5	186 39 47.8	+4 38 02.8	0.398 0547	186.45039	3.78750
	7 9648.5	190 23 40.1	4 16 55.8	.403 4634	190.18690	3.68664
	8 9649.5	194 01 29.5	3 55 19.3	.408 7247	193.82585	3.59234
	9 9650.5	197 33 40.7	3 33 20.9	.413 8216	197.37369	3.50439
	10 9651.5	201 00 37.4	3 11 07.2	.418 7387	200.83668	3.42259
	11 9652.5	204 22 42.6	+2 48 43.7	0.423 4622	204.22082	3.34665
	12 9653.5	207 40 18.3	2 26 15.5	.427 9807	207.53186	3.27636
	13 9654.5	210 53 45.7	2 03 46.7	.432 2830	210.77534	3.21148
	14 9655.5	214 03 24.7	1 41 21.0	.436 3601	213.95653	3.15174
	15 9656.5	217 09 34.7	1 19 01.5	.440 2035	217.08047	3.09694
	16 9657.5	220 12 34.0	+0 56 50.9	0.443 8059	220.15199	3.04687
	17 9658.5	223 12 40.1	0 34 51.5	.447 1611	223.17572	3.00132
	18 9659.5	226 10 09.9	+0 13 05.4	.450 2634	226.15608	2.96010
	19 9660.5	229 05 19.4	-0 08 25.6	.453 1079	229.09732	2.92306
	20 9661.5	231 58 24.1	0 29 39.9	.455 6904	232.00354	2.89003
	21 9662.5	234 49 38.7	-0 50 36.2	0.458 0073	234.87866	2.86085
	22 9663.5	237 39 17.7	1 11 13.1	.460 0555	237.72650	2.83544
	23 9664.5	240 27 34.8	1 31 29.6	.461 8322	240.55076	2.81367
	24 9665.5	243 14 43.6	1 51 24.4	.463 3353	243.35502	2.79545
	25 9666.5	246 00 57.1	2 10 56.5	.464 5630	246.14281	2.78069
	26 9667.5	248 46 28.2	-2 30 05.0	0.465 5140	248.91754	2.76933
	27 9668.5	251 31 29.5	2 48 48.7	.466 1867	251.68260	2.76134
	28 9669.5	254 16 13.3	3 07 06.6	.466 5807	254.44134	2.75669
	29 9670.5	257 00 52.1	3 24 57.6	.466 6955	257.19708	2.75534
	30 9671.5	259 45 37.9	3 42 20.6	.466 5310	259.95311	2.75727
July	1 9672.5	262 30 43.0	-3 59 14.2	0.466 0872	262.71273	2.76252
	2 9673.5	265 16 19.6	-4 15 37.3	0.465 3650	265.47927	2.77111

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
243						
July	1 9672.5	262° 30' 43.0	-3° 59' 14.2	0.466 0872	262.71273	2.76252
	2 9673.5	265 16 19.6	4 15 37.3	.465 3650	265.47927	2.77111
	3 9674.5	268 02 40.1	4 31 28.4	.464 3650	268.25607	2.78305
	4 9675.5	270 49 56.8	4 46 45.9	.463 0881	271.04652	2.79843
	5 9676.5	273 38 22.5	5 01 28.0	.461 5360	273.85408	2.81727
	6 9677.5	276 28 09.8	-5 15 32.9	0.459 7110	276.68225	2.83968
	7 9678.5	279 19 32.0	5 28 58.5	.457 6148	279.53467	2.86577
	8 9679.5	282 12 42.6	5 41 42.5	.455 2504	282.41504	2.89561
	9 9680.5	285 07 55.3	5 53 42.4	.452 6208	285.32719	2.92935
	10 9681.5	288 05 24.5	6 04 55.3	.449 7302	288.27509	2.96713
	11 9682.5	291 05 24.9	-6 15 18.1	0.446 5826	291.26285	3.00910
	12 9683.5	294 08 11.9	6 24 47.5	.443 1829	294.29475	3.05544
	13 9684.5	297 14 01.2	6 33 19.8	.439 5371	297.37525	3.10634
	14 9685.5	300 23 09.4	6 40 50.7	.435 6516	300.50901	3.16200
	15 9686.5	303 35 53.5	6 47 15.8	.431 5337	303.70090	3.22263
	16 9687.5	306 52 31.5	-6 52 30.1	0.427 1922	306.95600	3.28846
	17 9688.5	310 13 21.7	6 56 28.3	.422 6363	310.27964	3.35974
	18 9689.5	313 38 43.4	6 59 04.5	.417 8772	313.67738	3.43670
	19 9690.5	317 08 56.7	7 00 12.4	.412 9271	317.15502	3.51959
	20 9691.5	320 44 21.9	6 59 45.2	.407 7998	320.71862	3.60865
	21 9692.5	324 25 20.6	-6 57 35.6	0.402 5107	324.37446	3.70411
	22 9693.5	328 12 14.3	6 53 35.8	.397 0777	328.12904	3.80616
	23 9694.5	332 05 25.4	6 47 37.8	.391 5204	331.98904	3.91498
	24 9695.5	336 05 16.4	6 39 33.0	.385 8607	335.96129	4.03066
	25 9696.5	340 12 09.8	6 29 13.0	.380 1234	340.05267	4.15326
	26 9697.5	344 26 27.8	-6 16 29.1	0.374 3357	344.27008	4.28268
	27 9698.5	348 48 32.0	6 01 12.9	.368 5282	348.62024	4.41872
	28 9699.5	353 18 42.9	5 43 16.6	.362 7337	353.10961	4.56102
	29 9700.5	357 57 19.4	5 22 33.1	.356 9891	357.74417	4.70899
	30 9701.5	2 44 37.6	4 58 57.0	.351 3341	2.52920	4.86180
	31 9702.5	7 40 50.9	-4 32 24.7	0.345 8116	7.46900	5.01830
Aug.	1 9703.5	12 46 08.1	4 02 55.3	.340 4679	12.56656	5.17707
	2 9704.5	18 00 33.2	3 30 31.0	.335 3511	17.82328	5.33626
	3 9705.5	23 24 03.8	2 55 18.2	.330 5120	23.23849	5.49367
	4 9706.5	28 56 30.1	2 17 28.2	.326 0025	28.80916	5.64670
	5 9707.5	34 37 33.6	-1 37 17.3	0.321 8751	34.52946	5.79243
	6 9708.5	40 26 46.6	0 55 07.8	.318 1809	40.39054	5.92771
	7 9709.5	46 23 31.1	-0 11 27.8	.314 9691	46.38029	6.04922
	8 9710.5	52 26 58.4	+0 33 09.2	.312 2850	52.48328	6.15365
	9 9711.5	58 36 09.4	1 18 04.8	.310 1682	58.68087	6.23794
	10 9712.5	64 49 54.8	+2 02 37.1	0.308 6513	64.95154	6.29940
	11 9713.5	71 06 56.7	2 46 02.4	.307 7581	71.27137	6.33600
	12 9714.5	77 25 50.2	3 27 37.0	.307 5035	77.61483	6.34650
	13 9715.5	83 45 06.0	4 06 39.6	.307 8914	83.95554	6.33052
	14 9716.5	90 03 13.1	4 42 33.2	.308 9156	90.26722	6.28861
	15 9717.5	96 18 41.7	+5 14 46.6	0.310 5595	96.52459	6.22222
	16 9718.5	102 30 06.1	+5 42 56.1	0.312 7972	102.70421	6.13352

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Aug. 16	9718.5	102 30 06.1	+5 42 56.1	0.312 7972	102.70421	6.13352
17	9719.5	108 36 07.6	6 06 45.6	.315 5943	108.78510	6.02526
18	9720.5	114 35 36.5	6 26 07.2	.318 9103	114.74927	5.90062
19	9721.5	120 27 33.6	6 41 00.2	.322 6985	120.58198	5.76290
20	9722.5	126 11 11.2	6 51 30.6	.326 9096	126.27180	5.61538
21	9723.5	131 45 53.1	+6 57 49.6	0.331 4920	131.81053	5.46122
22	9724.5	137 11 14.3	7 00 12.7	.336 3930	137.19297	5.30325
23	9725.5	142 27 00.2	6 58 57.8	.341 5610	142.41660	5.14397
24	9726.5	147 33 05.6	6 54 24.9	.346 9459	147.48120	4.98554
25	9727.5	152 29 33.1	6 46 54.4	.352 4997	152.38854	4.82969
26	9728.5	157 16 32.0	+6 36 46.7	0.358 1768.	157.14190	4.67779
27	9729.5	161 54 16.8	6 24 21.6	.363 9351	161.74581	4.53094
28	9730.5	166 23 06.2	6 09 57.5	.369 7352	166.20572	4.38990
29	9731.5	170 43 22.0	5 53 51.7	.375 5414	170.52773	4.25521
30	9732.5	174 55 27.8	5 36 20.0	.381 3212	174.71837	4.12720
31	9733.5	178 59 48.7	+5 17 36.7	0.387 0446	178.78441	4.00604
Sept. 1	9734.5	182 56 50.4	4 57 54.3	.392 6849	182.73275	3.89178
2	9735.5	186 46 58.9	4 37 24.1	.398 2181	186.57026	3.78438
3	9736.5	190 30 40.0	4 16 16.1	.403 6228	190.30376	3.68372
4	9737.5	194 08 18.9	3 54 38.8	.408 8796	193.93988	3.58961
5	9738.5	197 40 20.3	+3 32 39.8	0.413 9716	197.48509	3.50184
6	9739.5	201 07 07.8	3 10 25.7	.418 8831	200.94561	3.42020
7	9740.5	204 29 04.6	2 48 02.0	.423 6008	204.32746	3.34445
8	9741.5	207 46 32.5	2 25 33.6	.428 1129	207.63638	3.27432
9	9742.5	210 59 52.6	2 03 04.9	.432 4088	210.87790	3.20959
10	9743.5	214 09 25.1	+1 40 39.3	0.436 4790	214.05727	3.15001
11	9744.5	217 15 29.0	1 18 20.0	.440 3154	217.17956	3.09536
12	9745.5	220 18 22.8	0 56 09.7	.443 9107	220.24956	3.04542
13	9746.5	223 18 23.9	0 34 10.7	.447 2584	223.27191	3.00001
14	9747.5	226 15 49.2	+0 12 25.0	.450 3529	226.25102	2.95891
15	9748.5	229 10 54.7	-0 09 05.5	0.453 1897	229.19113	2.92199
16	9749.5	232 03 55.8	0 30 19.3	.455 7643	232.09634	2.88908
17	9750.5	234 55 07.3	0 51 15.0	.458 0730	234.97057	2.86002
18	9751.5	237 44 43.5	1 11 51.3	.460 1130	237.81763	2.83472
19	9752.5	240 32 58.3	1 32 07.1	.461 8813	240.64122	2.81306
20	9753.5	243 20 05.2	-1 52 01.2	0.463 3762	243.44492	2.79493
21	9754.5	246 06 17.2	2 11 32.7	.464 5955	246.23224	2.78028
22	9755.5	248 51 47.2	2 30 40.4	.465 5381	249.00662	2.76904
23	9756.5	251 36 47.7	2 49 23.3	.466 2023	251.77144	2.76115
24	9757.5	254 21 31.2	3 07 40.3	.466 5878	254.53003	2.75659
25	9758.5	257 06 10.0	-3 25 30.5	0.466 6941	257.28572	2.75533
26	9759.5	259 50 56.2	3 42 52.6	.466 5211	260.04180	2.75739
27	9760.5	262 36 02.1	3 59 45.3	.466 0688	262.80159	2.76274
28	9761.5	265 21 39.9	4 16 07.4	.465 3379	265.56838	2.77141
29	9762.5	268 08 01.8	4 31 57.5	.464 3293	268.34554	2.78347
30	9763.5	270 55 20.5	-4 47 13.9	0.463 0439	271.13646	2.79894
Oct. 1	9764.5	273 43 48.4	-5 01 54.9	0.461 4835	273.94459	2.81791

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Oct. 1	9764.5	273 43 48.4	-5 01 54.9	0.461 4835	273.94459	2.81791
2	9765.5	276 33 38.4	5 15 58.6	.459 6499	276.77346	2.84043
3	9766.5	279 25 03.8	5 29 22.9	.457 5454	279.62668	2.86663
4	9767.5	282 18 17.9	5 42 05.6	.455 1728	282.50797	2.89659
5	9768.5	285 13 34.6	5 54 04.0	.452 5352	285.42116	2.93045
6	9769.5	288 11 08.2	-6 05 15.4	0.449 6364	288.37022	2.96835
7	9770.5	291 11 13.6	6 15 36.7	.446 4808	291.35927	3.01046
8	9771.5	294 14 05.9	6 25 04.4	.443 0736	294.39260	3.05695
9	9772.5	297 20 01.1	6 33 34.8	.439 4202	297.47468	3.10799
10	9773.5	300 29 15.7	6 41 03.7	.435 5273	300.61016	3.16379
11	9774.5	303 42 06.8	-6 47 26.7	0.431 4024	303.80393	3.22459
12	9775.5	306 58 52.3	6 52 38.7	.427 0539	307.06107	3.29058
13	9776.5	310 19 50.6	6 56 34.5	.422 4916	310.38691	3.36204
14	9777.5	313 45 21.1	6 59 08.0	.417 7264	313.78704	3.43918
15	9778.5	317 15 43.6	7 00 13.1	.412 7704	317.26725	3.52225
16	9779.5	320 51 18.9	-6 59 42.8	0.407 6377	320.83361	3.61151
17	9780.5	324 32 28.2	6 57 29.8	.402 3438	324.49241	3.70718
18	9781.5	328 19 33.4	6 53 26.5	.396 9066	328.25017	3.80944
19	9782.5	332 12 56.6	6 47 24.7	.391 3456	332.11355	3.91847
20	9783.5	336 13 00.3	6 39 15.9	.385 6831	336.08940	4.03437
21	9784.5	340 20 07.2	-6 28 51.5	0.379 9437	340.18460	4.15719
22	9785.5	344 34 39.4	6 16 03.0	.374 1548	344.40605	4.28682
23	9786.5	348 56 58.5	6 00 41.9	.368 3470	348.76045	4.42306
24	9787.5	353 27 24.9	5 42 40.5	.362 5534	353.25426	4.56555
25	9788.5	358 06 17.4	5 21 51.7	.356 8108	357.89343	4.71368
26	9789.5	2 53 52.2	-4 58 10.2	0.351 1592	2.68323	4.86663
27	9790.5	7 50 22.3	4 31 32.4	.345 6417	7.62792	5.02325
28	9791.5	12 55 56.7	4 01 57.4	.340 3041	12.73046	5.18206
29	9792.5	18 10 39.0	3 29 27.8	.335 1951	17.99216	5.34123
30	9793.5	23 34 26.5	2 54 09.9	.330 3652	23.41230	5.49854
31	9794.5	29 07 09.3	-2 16 15.2	0.325 8667	28.98775	5.65139
Nov. 1	9795.5	34 48 28.7	1 36 00.2	.321 7521	34.71262	5.79686
2	9796.5	40 37 56.5	0 53 47.5	.318 0723	40.57794	5.93176
3	9797.5	46 34 54.5	-0 10 05.1	.314 8762	46.57151	6.05280
4	9798.5	52 38 33.6	+0 34 33.1	.312 2091	52.67780	6.15665
5	9799.5	58 47 54.4	+1 19 28.6	0.310 1104	58.87805	6.24025
6	9800.5	65 01 47.3	2 03 59.5	.308 6127	65.15066	6.30097
7	9801.5	71 18 54.1	2 47 22.0	.307 7393	71.47167	6.33677
8	9802.5	77 37 49.8	3 28 52.5	.307 5048	77.81549	6.34645
9	9803.5	83 57 05.1	4 07 49.8	.307 9128	84.15574	6.32964
10	9804.5	90 15 08.7	+4 43 37.0	0.308 9565	90.46614	6.28695
11	9805.5	96 30 31.1	5 15 43.1	.310 6194	96.72148	6.21982
12	9806.5	102 41 46.7	5 43 44.7	.312 8751	102.89836	6.13045
13	9807.5	108 47 37.2	6 07 25.9	.315 6893	108.97590	6.02163
14	9808.5	114 46 52.9	6 26 39.1	.319 0208	114.93620	5.89653
15	9809.5	120 38 35.2	+6 41 23.8	0.322 8229	120.76464	5.75845
16	9810.5	126 21 56.6	+6 51 46.2	0.327 0464	126.44987	5.61068

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Nov. 16	9810.5	126 21 56.6	+6 51 46.2	0.327 0464	126.44987	5.61068
17	9811.5	131 56 21.4	6 57 57.6	.331 6396	131.98381	5.45635
18	9812.5	137 21 24.8	7 00 13.5	.336 5498	137.36133	5.29829
19	9813.5	142 36 52.7	6 58 52.2	.341 7254	142.57999	5.13901
20	9814.5	147 42 40.0	6 54 13.4	.347 1165	147.63966	4.98063
21	9815.5	152 38 49.6	+6 46 37.7	0.352 6748	152.54213	4.82488
22	9816.5	157 25 30.9	6 36 25.5	.358 3552	157.29075	4.67313
23	9817.5	162 02 58.7	6 23 56.3	.364 1154	161.89008	4.52645
24	9818.5	166 31 31.8	6 09 28.8	.369 9163	166.34559	4.38559
25	9819.5	170 51 31.8	5 53 20.1	.375 7222	170.66339	4.25111
26	9820.5	175 03 22.7	+5 35 46.0	0.381 5007	174.85003	4.12330
27	9821.5	179 07 29.5	5 17 00.6	.387 2220	178.91228	4.00236
28	9822.5	183 04 17.9	4 57 16.5	.392 8594	182.85705	3.88832
29	9823.5	186 54 13.9	4 36 45.1	.398 3890	186.69121	3.78113
30	9824.5	190 37 43.3	4 15 36.0	.403 7893	190.42156	3.68067
Dec. 1	9825.5	194 15 11.3	+3 53 57.9	0.409 0411	194.05474	3.58676
2	9826.5	197 47 02.4	3 31 58.4	.414 1276	197.59720	3.49920
3	9827.5	201 13 40.6	3 09 43.9	.419 0334	201.05518	3.41775
4	9828.5	204 35 28.6	2 47 20.0	.423 7450	204.43466	3.34217
5	9829.5	207 52 48.5	2 24 51.6	.428 2506	207.74139	3.27221
6	9830.5	211 06 01.1	+2 02 22.8	0.432 5396	210.98088	3.20764
7	9831.5	214 15 26.7	1 39 57.4	.436 6026	214.15839	3.14821
8	9832.5	217 21 24.4	1 17 38.3	.440 4314	217.27895	3.09372
9	9833.5	220 24 12.6	0 55 28.3	.444 0189	220.34740	3.04393
10	9834.5	223 24 08.6	0 33 29.7	.447 3587	223.36832	2.99865
11	9835.5	226 21 29.2	+0 11 44.6	0.450 4453	226.34615	2.95770
12	9836.5	229 16 30.6	-0 09 45.5	.453 2739	229.28511	2.92090
13	9837.5	232 09 28.0	0 30 58.7	.455 8404	232.18928	2.88811
14	9838.5	235 00 36.3	0 51 53.9	.458 1407	235.06261	2.85918
15	9839.5	237 50 09.8	1 12 29.6	.460 1723	237.90888	2.83399
16	9840.5	240 38 22.3	-1 32 44.7	0.461 9322	240.73180	2.81243
17	9841.5	243 25 27.2	1 52 38.1	.463 4184	243.53493	2.79442
18	9842.5	246 11 37.8	2 12 08.8	.464 6291	246.32180	2.77988
19	9843.5	248 57 06.6	2 31 15.8	.465 5627	249.09583	2.76874
20	9844.5	251 42 06.4	2 49 57.9	.466 2183	251.86040	2.76097
21	9845.5	254 26 49.6	-3 08 14.1	0.466 5950	254.61887	2.75651
22	9846.5	257 11 28.5	3 26 03.4	.466 6925	257.37452	2.75535
23	9847.5	259 56 15.1	3 43 24.6	.466 5108	260.13068	2.75750
24	9848.5	262 41 21.9	4 00 16.4	.466 0499	262.89063	2.76296
25	9849.5	265 27 00.9	4 16 37.6	.465 3102	265.65771	2.77175
26	9850.5	268 13 24.5	-4 32 26.6	0.464 2930	268.43526	2.78391
27	9851.5	271 00 45.1	4 47 41.9	.462 9988	271.22668	2.79950
28	9852.5	273 49 15.4	5 02 21.8	.461 4298	274.03542	2.81856
29	9853.5	276 39 08.3	5 16 24.3	.459 5877	276.86500	2.84121
30	9854.5	279 30 36.8	5 29 47.4	.457 4747	279.71905	2.86750
31	9855.5	282 23 54.6	-5 42 28.7	0.455 0937	282.60127	2.89759
32	9856.5	285 19 15.4	-5 54 25.7	0.452 4478	285.51553	2.93159

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
Jan.	243 0 9490.5	308° 36' 57.9	-2° 41' 03.6	0.728 2377	308.66479	1.58062	+0.35
	2 9492.5	311 46 44.4	2 47 41.3	.728 2406	311.82601	.58061	.34
	4 9494.5	314 56 33.1	2 53 48.5	.728 2283	314.98727	.58066	.33
	6 9496.5	318 06 24.3	2 59 23.9	.728 2010	318.14871	.58078	.32
	8 9498.5	321 16 18.5	3 04 26.6	.728 1586	321.31044	.58096	.31
	10 9500.5	324 26 15.9	-3 08 55.6	0.728 1014	324.47261	1.58121	+0.30
	12 9502.5	327 36 16.9	3 12 50.2	.728 0294	327.63534	.58153	.29
	14 9504.5	330 46 21.7	3 16 09.5	.727 9429	330.79876	.58190	.28
	16 9506.5	333 56 30.6	3 18 52.9	.727 8422	333.96299	.58234	.27
	18 9508.5	337 06 43.8	3 21 00.0	.727 7276	337.12816	.58284	.26
	20 9510.5	340 17 01.5	-3 22 30.2	0.727 5994	340.29438	1.58339	+0.24
	22 9512.5	343 27 23.9	3 23 23.4	.727 4579	343.46177	.58401	.22
	24 9514.5	346 37 51.2	3 23 39.2	.727 3037	346.63045	.58468	.21
	26 9516.5	349 48 23.5	3 23 17.6	.727 1371	349.80053	.58541	.19
	28 9518.5	352 59 00.9	3 22 18.5	.726 9587	352.97211	.58618	.17
Feb.	30 9520.5	356 09 43.6	-3 20 42.2	0.726 7691	356.14530	1.58701	+0.15
	1 9522.5	359 20 31.8	3 18 28.9	.726 5687	359.32019	.58789	.13
	3 9524.5	2 31 25.4	3 15 38.8	.726 3583	2.49688	.58881	.11
	5 9526.5	5 42 24.6	3 12 12.5	.726 1384	5.67545	.58977	.08
	7 9528.5	8 53 29.6	3 08 10.6	.725 9097	8.85599	.59077	.06
	9 9530.5	12 04 40.3	-3 03 33.6	0.725 6729	12.03857	1.59181	+0.03
	11 9532.5	15 15 56.8	2 58 22.5	.725 4287	15.22325	.59288	+ .01
	13 9534.5	18 27 19.3	2 52 38.1	.725 1779	18.41011	.59398	- .01
	15 9536.5	21 38 47.8	2 46 21.3	.724 9213	21.59920	.59511	.03
	17 9538.5	24 50 22.4	2 39 33.4	.724 6596	24.79057	.59626	.05
	19 9540.5	28 02 03.2	-2 32 15.4	0.724 3936	27.98426	1.59743	-0.07
	21 9542.5	31 13 50.2	2 24 28.7	.724 1243	31.18031	.59862	.09
	23 9544.5	34 25 43.6	2 16 14.8	.723 8523	34.37876	.59982	.11
	25 9546.5	37 37 43.4	2 07 34.9	.723 5785	37.57961	.60103	.14
	27 9548.5	40 49 49.8	1 58 30.9	.723 3039	40.78289	.60225	.16
Mar.	1 9550.5	44 02 02.8	-1 49 04.2	0.723 0293	43.98861	1.60347	-0.18
	3 9552.5	47 14 22.5	1 39 16.6	.722 7554	47.19677	.60468	.20
	5 9554.5	50 26 49.0	1 29 10.0	.722 4833	50.40734	.60589	.23
	7 9556.5	53 39 22.3	1 18 46.1	.722 2137	53.62033	.60709	.25
	9 9558.5	56 52 02.6	1 08 06.9	.721 9474	56.83570	.60828	.27
	11 9560.5	60 04 50.0	-0 57 14.4	0.721 6854	60.05343	1.60945	-0.29
	13 9562.5	63 17 44.4	0 46 10.6	.721 4285	63.27347	.61059	.30
	15 9564.5	66 30 46.0	0 34 57.7	.721 1774	66.49578	.61171	.32
	17 9566.5	69 43 54.8	0 23 37.6	.720 9330	69.72030	.61281	.34
	19 9568.5	72 57 10.8	0 12 12.6	.720 6960	72.94699	.61387	.36
	21 9570.5	76 10 34.0	-0 00 44.9	0.720 4672	76.17575	1.61489	-0.37
	23 9572.5	79 24 04.5	+0 10 43.4	.720 2474	79.40653	.61588	.39
	25 9574.5	82 37 42.1	0 22 10.1	.720 0373	82.63924	.61682	.41
	27 9576.5	85 51 26.8	0 33 32.9	.719 8375	85.87379	.61772	.41
	29 9578.5	89 05 18.6	0 44 49.7	.719 6486	89.11009	.61857	.42
Apr.	31 9580.5	92 19 17.2	+0 55 58.3	0.719 4714	92.34803	1.61937	-0.43
	2 9582.5	95 33 22.7	+1 06 56.6	0.719 3063	95.58752	1.62011	-0.44

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.	
243								
Apr.	2	9582.5	95 33 22.7	+1 06 56.6	0.719 3063	95.58752	1.62011	-0.44
	4	9584.5	98 47 34.7	1 17 42.3	.719 1538	98.82844	.62080	.44
	6	9586.5	102 01 53.1	1 28 13.4	.719 0146	102.07068	.62143	.45
	8	9588.5	105 16 17.5	1 38 27.8	.718 8890	105.31411	.62199	.45
	10	9590.5	108 30 47.8	1 48 23.5	.718 7774	108.55861	.62250	.45
	12	9592.5	111 45 23.6	+1 57 58.6	0.718 6802	111.80405	1.62294	-0.45
	14	9594.5	115 00 04.5	2 07 11.2	.718 5978	115.05031	.62331	.45
	16	9596.5	118 14 50.0	2 15 59.4	.718 5303	118.29724	.62361	.45
	18	9598.5	121 29 39.9	2 24 21.5	.718 4781	121.54471	.62385	.45
	20	9600.5	124 44 33.5	2 32 15.9	.718 4413	124.79259	.62402	.44
22	9602.5	127 59 30.4	+2 39 41.1	0.718 4200	128.04073	1.62411	-0.43	
24	9604.5	131 14 30.0	2 46 35.5	.718 4142	131.28900	.62414	.42	
26	9606.5	134 29 31.7	2 52 57.7	.718 4241	134.53724	.62409	.41	
28	9608.5	137 44 34.9	2 58 46.7	.718 4494	137.78532	.62398	.40	
30	9610.5	140 59 39.0	3 04 01.1	.718 4903	141.03311	.62379	.39	
May	2	9612.5	144 14 43.3	+3 08 40.0	0.718 5465	144.28045	1.62354	-0.38
	4	9614.5	147 29 47.1	3 12 42.5	.718 6179	147.52722	.62322	.36
	6	9616.5	150 44 49.8	3 16 07.8	.718 7042	150.77327	.62283	.34
	8	9618.5	153 59 50.7	3 18 55.3	.718 8052	154.01848	.62237	.32
	10	9620.5	157 14 49.0	3 21 04.4	.718 9205	157.26271	.62185	.30
	12	9622.5	160 29 44.1	+3 22 34.9	0.719 0497	160.50584	1.62127	-0.28
	14	9624.5	163 44 35.2	3 23 26.3	.719 1924	163.74774	.62062	.25
	16	9626.5	166 59 21.7	3 23 38.6	.719 3481	166.98830	.61993	.23
	18	9628.5	170 14 02.9	3 23 11.8	.719 5165	170.22740	.61916	.20
	20	9630.5	173 28 38.0	3 22 06.1	.719 6968	173.46492	.61835	.18
22	9632.5	176 43 06.6	+3 20 21.7	0.719 8885	176.70077	1.61749	-0.15	
24	9634.5	179 57 28.0	3 17 59.0	.720 0910	179.93484	.61658	.12	
26	9636.5	183 11 41.6	3 14 58.5	.720 3037	183.16706	.61563	.09	
28	9638.5	186 25 46.9	3 11 20.9	.720 5258	186.39732	.61463	.06	
30	9640.5	189 39 43.4	3 07 07.0	.720 7567	189.62555	.61360	-.03	
June	1	9642.5	192 53 30.6	+3 02 17.7	0.720 9955	192.85168	1.61253	0.00
	3	9644.5	196 07 08.2	2 56 53.9	.721 2417	196.07563	.61142	+ .03
	5	9646.5	199 20 35.8	2 50 56.8	.721 4942	199.29736	.61030	.05
	7	9648.5	202 33 53.0	2 44 27.5	.721 7525	202.51681	.60915	.08
	9	9650.5	205 46 59.7	2 37 27.5	.722 0155	205.73393	.60797	.11
	11	9652.5	208 59 55.7	+2 29 58.0	0.722 2826	208.94869	1.60679	+0.14
	13	9654.5	212 12 40.8	2 22 00.6	.722 5528	212.16106	.60558	.16
	15	9656.5	215 25 14.9	2 13 36.8	.722 8253	215.37101	.60437	.19
	17	9658.5	218 37 38.1	2 04 48.3	.723 0993	218.57854	.60316	.22
	19	9660.5	221 49 50.3	1 55 36.8	.723 3739	221.78364	.60194	.25
21	9662.5	225 01 51.7	+1 46 04.2	0.723 6482	224.98630	1.60072	+0.27	
23	9664.5	228 13 42.3	1 36 12.1	.723 9214	228.18654	.59952	.30	
25	9666.5	231 25 22.4	1 26 02.6	.724 1927	231.38438	.59832	.33	
27	9668.5	234 36 52.2	1 15 37.4	.724 4611	234.57983	.59714	.36	
29	9670.5	237 48 12.1	1 04 58.7	.724 7259	237.77294	.59597	.38	
July	1	9672.5	240 59 22.2	+0 54 08.4	0.724 9862	240.96373	1.59482	+0.40
	3	9674.5	244 10 23.1	+0 43 08.6	0.725 2412	244.15225	1.59370	+0.43

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
July	243	° ′ ″	° ′ ″		° ′ ″	° ′ ″	° ′ ″
	1 9672.5	240 59 22.2	+0 54 08.4	0.724 9862	240.96373	1.59482	+0.40
	3 9674.5	244 10 23.1	0 43 08.6	.725 2412	244.15225	.59370	.43
	5 9676.5	247 21 15.0	0 32 01.2	.725 4902	247.33856	.59261	.45
	7 9678.5	250 31 58.6	0 20 48.3	.725 7324	250.52271	.59155	.47
	9 9680.5	253 42 34.1	+0 09 32.1	.725 9671	253.70478	.59052	.49
	11 9682.5	256 53 02.2	-0 01 45.5	0.726 1935	256.88482	1.58953	+0.50
	13 9684.5	260 03 23.4	0 13 02.4	.726 4109	260.06292	.58858	.52
	15 9686.5	263 13 38.1	0 24 16.4	.726 6187	263.23916	.58767	.54
	17 9688.5	266 23 47.0	0 35 25.6	.726 8163	266.41363	.58681	.56
	19 9690.5	269 33 50.7	0 46 28.0	.727 0031	269.58643	.58599	.58
	21 9692.5	272 43 49.6	-0 57 21.5	0.727 1784	272.75764	1.58523	+0.59
	23 9694.5	275 53 44.5	1 08 04.2	.727 3418	275.92738	.58452	.59
	25 9696.5	279 03 35.8	1 18 34.2	.727 4928	279.09575	.58386	.60
	27 9698.5	282 13 24.2	1 28 49.6	.727 6310	282.26286	.58326	.61
	29 9700.5	285 23 10.2	1 38 48.5	.727 7558	285.42883	.58272	.62
	31 9702.5	288 32 54.3	-1 48 29.2	0.727 8670	288.59378	1.58223	+0.62
Aug.	2 9704.5	291 42 37.2	1 57 49.9	.727 9642	291.75781	.58181	.62
	4 9706.5	294 52 19.4	2 06 49.0	.728 0471	294.92107	.58146	.63
	6 9708.5	298 02 01.4	2 15 24.8	.728 1155	298.08368	.58116	.63
	8 9710.5	301 11 43.6	2 23 35.8	.728 1692	301.24575	.58093	.63
	10 9712.5	304 21 26.7	-2 31 20.6	0.728 2079	304.40743	1.58076	+0.63
	12 9714.5	307 31 10.9	2 38 37.7	.728 2318	307.56883	.58065	.62
	14 9716.5	310 40 56.8	2 45 25.9	.728 2405	310.73009	.58062	.62
	16 9718.5	313 50 44.7	2 51 43.8	.728 2342	313.89135	.58065	.62
	18 9720.5	317 00 35.1	2 57 30.4	.728 2129	317.05273	.58074	.62
	20 9722.5	320 10 28.2	-3 02 44.6	0.728 1765	320.21435	1.58090	+0.61
	22 9724.5	323 20 24.5	3 07 25.5	.728 1253	323.37636	.58112	.61
	24 9726.5	326 30 24.2	3 11 32.1	.728 0594	326.53888	.58141	.61
	26 9728.5	329 40 27.7	3 15 03.8	.727 9790	329.70204	.58176	.60
	28 9730.5	332 50 35.1	3 17 59.8	.727 8842	332.86596	.58217	.60
	30 9732.5	336 00 46.7	-3 20 19.6	0.727 7755	336.03076	1.58264	+0.59
	1 9734.5	339 11 02.7	3 22 02.7	.727 6532	339.19657	.58318	.59
	3 9736.5	342 21 23.2	3 23 08.8	.727 5175	342.36351	.58377	.59
	5 9738.5	345 31 48.6	3 23 37.6	.727 3690	345.53167	.58441	.58
	7 9740.5	348 42 18.9	3 23 29.0	.727 2080	348.70118	.58511	.58
	9 9742.5	351 52 54.2	-3 22 43.0	0.727 0351	351.87215	1.58587	+0.58
Sept.	11 9744.5	355 03 34.8	3 21 19.6	.726 8507	355.04468	.58667	.58
	13 9746.5	358 14 20.6	3 19 19.1	.726 6555	358.21886	.58752	.57
	15 9748.5	1 25 11.9	3 16 41.8	.726 4499	1.39479	.58842	.57
	17 9750.5	4 36 08.7	3 13 28.1	.726 2347	4.57256	.58936	.57
	19 9752.5	7 47 11.1	-3 09 38.5	0.726 0105	7.75226	1.59034	+0.57
	21 9754.5	10 58 19.1	3 05 13.6	.725 7780	10.93395	.59136	.56
	23 9756.5	14 09 33.0	3 00 14.3	.725 5378	14.11771	.59241	.56
	25 9758.5	17 20 52.7	2 54 41.4	.725 2907	17.30362	.59350	.56
	27 9760.5	20 32 18.4	2 48 35.8	.725 0374	20.49172	.59461	.56
	29 9762.5	23 43 50.1	-2 41 58.6	0.724 7788	23.68207	1.59575	+0.55
Oct. 1	9764.5	26 55 27.8	-2 34 51.0	0.724 5155	26.87472	1.59690	+0.55

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
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Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
Oct. 1	9764.5	26° 55' 27.8"	-2° 34' 51.0"	0.724 5155	26.87472	1.59690	+0.55
3	9766.5	30 07 11.8	2 27 14.2	.724 2486	30.06970	.59808	.54
5	9768.5	33 19 02.1	2 19 09.7	.723 9786	33.26705	.59927	.53
7	9770.5	36 30 58.7	2 10 38.7	.723 7065	36.46679	.60047	.52
9	9772.5	39 43 01.7	2 01 43.0	.723 4332	39.66894	.60168	.51
11	9774.5	42 55 11.3	-1 52 24.0	0.723 1594	42.87352	1.60290	+0.50
13	9776.5	46 07 27.6	1 42 43.6	.722 8861	46.08052	.60411	.49
15	9778.5	49 19 50.6	1 32 43.5	.722 6140	49.28994	.60531	.48
17	9780.5	52 32 20.4	1 22 25.4	.722 3441	52.50177	.60651	.47
19	9782.5	55 44 57.1	1 11 51.4	.722 0771	55.71599	.60770	.45
21	9784.5	58 57 40.8	-1 01 03.4	0.721 8140	58.93257	1.60887	+0.43
23	9786.5	62 10 31.6	0 50 03.4	.721 5555	62.15147	.61003	.42
25	9788.5	65 23 29.4	0 38 53.5	.721 3024	65.37266	.61116	.40
27	9790.5	68 36 34.5	0 27 35.8	.721 0557	68.59608	.61226	.38
29	9792.5	71 49 46.7	0 16 12.4	.720 8160	71.82167	.61333	.35
31	9794.5	75 03 06.2	-0 04 45.4	0.720 5841	75.04938	1.61437	+0.32
Nov. 2	9796.5	78 16 32.9	+0 06 42.8	.720 3607	78.27912	.61537	.29
4	9798.5	81 30 06.8	0 18 10.2	.720 1467	81.51083	.61633	.27
6	9800.5	84 43 47.9	0 29 34.6	.719 9426	84.74441	.61725	.24
8	9802.5	87 57 36.0	0 40 53.7	.719 7491	87.97978	.61812	.21
10	9804.5	91 11 31.1	+0 52 05.4	0.719 5669	91.21684	1.61894	+0.18
12	9806.5	94 25 33.1	1 03 07.4	.719 3965	94.45549	.61970	.15
14	9808.5	97 39 41.7	1 13 57.6	.719 2385	97.69562	.62042	.12
16	9810.5	100 53 56.8	1 24 34.0	.719 0934	100.93712	.62107	.09
18	9812.5	104 08 18.2	1 34 54.4	.718 9617	104.17986	.62166	.06
20	9814.5	107 22 45.5	+1 44 56.9	0.718 8437	107.42373	1.62220	+0.03
22	9816.5	110 37 18.5	1 54 39.4	.718 7399	110.66861	.62267	.00
24	9818.5	113 51 56.8	2 04 00.0	.718 6506	113.91435	.62307	-.03
26	9820.5	117 06 39.9	2 12 56.9	.718 5762	117.16083	.62340	.06
28	9822.5	120 21 27.6	2 21 28.4	.718 5168	120.40792	.62367	.08
30	9824.5	123 36 19.2	+2 29 32.7	0.718 4727	123.65548	1.62387	-0.11
Dec. 2	9826.5	126 51 14.4	2 37 08.2	.718 4439	126.90336	.62400	.14
4	9828.5	130 06 12.5	2 44 13.5	.718 4307	130.15144	.62406	.17
6	9830.5	133 21 13.0	2 50 47.2	.718 4329	133.39957	.62405	.19
8	9832.5	136 36 15.3	2 56 47.9	.718 4507	136.64761	.62397	.22
10	9834.5	139 51 18.8	+3 02 14.6	0.718 4840	139.89541	1.62382	-0.25
12	9836.5	143 06 22.9	3 07 06.0	.718 5326	143.14285	.62360	.28
14	9838.5	146 21 26.7	3 11 21.4	.718 5964	146.38978	.62331	.30
16	9840.5	149 36 29.8	3 14 59.9	.718 6752	149.63606	.62296	.32
18	9842.5	152 51 31.3	3 18 00.7	.718 7688	152.88157	.62254	.35
20	9844.5	156 06 30.6	+3 20 23.3	0.718 8768	156.12616	1.62205	-0.37
22	9846.5	159 21 27.0	3 22 07.4	.718 9988	159.36972	.62150	.39
24	9848.5	162 36 19.8	3 23 12.5	.719 1346	162.61211	.62088	.40
26	9850.5	165 51 08.2	3 23 38.6	.719 2836	165.85321	.62021	.42
28	9852.5	169 05 51.6	3 23 25.5	.719 4454	169.09292	.61948	.43
30	9854.5	172 20 29.3	+3 22 33.4	0.719 6194	172.33111	1.61870	-0.44
32	9856.5	175 35 00.7	+3 21 02.5	0.719 8051	175.56769	1.61787	-0.45

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243						
Jan. -2	9488.5	156° 43' 59.0	+1° 45' 53.6	1.665 967	156.72452	0.436 472	-0.46
2	9492.5	158 28 47.5	1 44 49.8	.665 773	158.47058	.436 574	.46
6	9496.5	160 13 37.9	1 43 40.2	.665 420	160.21722	.436 759	.45
10	9500.5	161 58 31.4	1 42 24.8	.664 908	161.96476	.437 025	.45
14	9504.5	163 43 29.2	1 41 03.7	.664 237	163.71353	.437 376	.45
18	9508.5	165 28 32.5	+1 39 36.8	1.663 409	165.46388	0.437 811	-0.45
22	9512.5	167 13 42.6	1 38 04.2	.662 423	167.21613	.438 330	.45
26	9516.5	168 59 00.5	1 36 25.9	.661 280	168.97063	.438 932	.46
30	9520.5	170 44 27.6	1 34 42.1	.659 982	170.72770	.439 618	.46
Feb. 3	9524.5	172 30 05.0	1 32 52.8	.658 528	172.48769	.440 390	.46
7	9528.5	174 15 53.9	+1 30 58.0	1.656 921	174.25093	0.441 244	-0.46
11	9532.5	176 01 55.4	1 28 57.7	.655 162	176.01775	.442 181	.46
15	9536.5	177 48 10.9	1 26 52.2	.653 251	177.78849	.443 202	.46
19	9540.5	179 34 41.6	1 24 41.3	.651 190	179.56348	.444 307	.46
23	9544.5	181 21 28.5	1 22 25.2	.648 981	181.34306	.445 498	.46
27	9548.5	183 08 33.0	+1 20 03.9	1.646 626	183.12758	0.446 775	-0.45
Mar. 3	9552.5	184 55 56.3	1 17 37.5	.644 126	184.91737	.448 134	.45
7	9556.5	186 43 39.5	1 15 06.1	.641 483	186.71276	.449 576	.46
11	9560.5	188 31 43.9	1 12 29.8	.638 700	188.51409	.451 105	.47
15	9564.5	190 20 10.7	1 09 48.6	.635 779	190.32171	.452 717	.47
19	9568.5	192 09 01.2	+1 07 02.6	1.632 722	192.13594	0.454 413	-0.47
23	9572.5	193 58 16.4	1 04 11.9	.629 532	193.95713	.456 195	.46
27	9576.5	195 47 57.7	1 01 16.6	.626 211	195.78561	.458 058	.46
31	9580.5	197 38 06.2	0 58 16.9	.622 763	197.62171	.460 007	.46
Apr. 4	9584.5	199 28 43.2	0 55 12.7	.619 189	199.46578	.462 039	.46
8	9588.5	201 19 49.8	+0 52 04.3	1.615 495	201.31813	0.464 154	-0.45
12	9592.5	203 11 27.3	0 48 51.7	.611 682	203.17912	.466 353	.45
16	9596.5	205 03 36.9	0 45 35.0	.607 754	205.04906	.468 632	.44
20	9600.5	206 56 19.7	0 42 14.5	.603 716	206.92829	.470 998	.44
24	9604.5	208 49 37.0	0 38 50.2	.599 570	208.81715	.473 443	.44
28	9608.5	210 43 29.9	+0 35 22.2	1.595 320	210.71594	0.475 966	-0.43
May 2	9612.5	212 37 59.5	0 31 50.8	.590 972	212.62499	.478 572	.43
6	9616.5	214 33 07.1	0 28 16.1	.586 528	214.54462	.481 257	.42
10	9620.5	216 28 53.8	0 24 38.2	.581 994	216.47515	.484 020	.41
14	9624.5	218 25 20.7	0 20 57.4	.577 374	218.41688	.486 859	.41
18	9628.5	220 22 28.9	+0 17 13.8	1.572 674	220.37012	0.489 774	-0.40
22	9632.5	222 20 19.6	0 13 27.7	.567 897	222.33517	.492 763	.39
26	9636.5	224 18 53.7	0 09 39.2	.563 049	224.31232	.495 823	.38
30	9640.5	226 18 12.3	0 05 48.6	.558 136	226.30185	.498 956	.37
June 3	9644.5	228 18 16.5	+0 01 56.1	.553 163	228.30406	.502 157	.36
7	9648.5	230 19 07.2	-0 01 58.1	1.548 136	230.31919	0.505 421	-0.35
11	9652.5	232 20 45.4	0 05 53.6	.543 060	232.34752	.508 754	.35
15	9656.5	234 23 12.0	0 09 50.3	.537 943	234.38930	.512 145	.34
19	9660.5	236 26 27.9	0 13 47.7	.532 789	236.44476	.515 595	.33
23	9664.5	238 30 33.9	0 17 45.7	.527 605	238.51413	.519 099	.31
27	9668.5	240 35 30.8	-0 21 44.0	1.522 399	240.59762	0.522 656	-0.29
July 1	9672.5	242 41 19.4	-0 25 42.1	1.517 176	242.69544	0.526 260	-0.27

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion	Orb. Lat.
	243	° ' "	° ' "		°	°	"
July 1	9672.5	242 41 19.4	-0 25 42.1	1.517 176	242.69544	0.526 260	-0.27
5	9676.5	244 48 00.3	0 29 39.8	.511 944	244.80776	.529 908	.26
9	9680.5	246 55 34.1	0 33 36.7	.506 710	246.93476	.533 598	.25
13	9684.5	249 04 01.5	0 37 32.4	.501 481	249.07659	.537 321	.23
17	9688.5	251 13 22.9	0 41 26.6	.496 264	251.23337	.541 073	.22
21	9692.5	253 23 38.7	-0 45 18.9	1.491 067	253.40521	0.544 853	-0.20
25	9696.5	255 34 49.3	0 49 08.9	.485 897	255.59222	.548 652	.19
29	9700.5	257 46 54.9	0 52 56.1	.480 763	257.79444	.552 462	.17
Aug. 2	9704.5	259 59 55.7	0 56 40.2	.475 672	260.01193	.556 281	.15
6	9708.5	262 13 51.8	1 00 20.6	.470 632	262.24469	.560 100	.14
10	9712.5	264 28 43.2	-1 03 57.1	1.465 651	264.49272	0.563 914	-0.12
14	9716.5	266 44 29.6	1 07 29.0	.460 737	266.75598	.567 713	.11
18	9720.5	269 01 11.0	1 10 56.0	.455 899	269.03440	.571 494	.09
22	9724.5	271 18 46.9	1 14 17.5	.451 144	271.32789	.575 244	.07
26	9728.5	273 37 16.9	1 17 33.1	.446 481	273.63630	.578 957	.06
30	9732.5	275 56 40.5	-1 20 42.4	1.441 918	275.95949	0.582 629	-0.04
Sept. 3	9736.5	278 16 56.9	1 23 44.9	.437 463	278.29726	.586 247	.03
7	9740.5	280 38 05.3	1 26 40.0	.433 124	280.64938	.589 802	-.02
11	9744.5	283 00 04.8	1 29 27.3	.428 910	283.01558	.593 286	.00
15	9748.5	285 22 54.2	1 32 06.4	.424 827	285.39556	.596 690	+ .02
19	9752.5	287 46 32.4	-1 34 36.7	1.420 885	287.78898	0.600 005	+0.03
23	9756.5	290 10 58.0	1 36 57.9	.417 090	290.19547	.603 223	.05
27	9760.5	292 36 09.5	1 39 09.5	.413 451	292.61462	.606 332	.07
Oct. 1	9764.5	295 02 05.2	1 41 11.1	.409 974	295.04597	.609 326	.09
5	9768.5	297 28 43.5	1 43 02.2	.406 667	297.48906	.612 195	.10
9	9772.5	299 56 02.4	-1 44 42.6	1.403 536	299.94335	0.614 927	+0.12
13	9776.5	302 23 59.9	1 46 11.7	.400 588	302.40829	.617 519	.13
17	9780.5	304 52 33.9	1 47 29.4	.397 830	304.88330	.619 959	.14
21	9784.5	307 21 42.1	1 48 35.3	.395 266	307.36775	.622 238	.15
25	9788.5	309 51 22.1	1 49 29.1	.392 904	309.86098	.624 350	.16
29	9792.5	312 21 31.5	-1 50 10.5	1.390 747	312.36232	0.626 291	+0.17
Nov. 2	9796.5	314 52 07.5	1 50 39.4	.388 800	314.87106	.628 046	.18
6	9800.5	317 23 07.6	1 50 55.6	.387 069	317.38644	.629 615	.19
10	9804.5	319 54 28.9	1 50 59.0	.385 556	319.90772	.630 991	.19
14	9808.5	322 26 08.6	1 50 49.5	.384 266	322.43410	.632 166	.20
18	9812.5	324 58 03.8	-1 50 27.0	1.383 200	324.96478	0.633 141	+0.20
22	9816.5	327 30 11.4	1 49 51.4	.382 363	327.49895	.633 907	.21
26	9820.5	330 02 28.4	1 49 03.0	.381 754	330.03576	.634 464	.22
30	9824.5	332 34 51.8	1 48 01.6	.381 377	332.57438	.634 812	.22
Dec. 4	9828.5	335 07 18.5	1 46 47.5	.381 231	335.11397	.634 946	.23
8	9832.5	337 39 45.3	-1 45 20.8	1.381 317	337.65366	0.634 865	+0.23
12	9836.5	340 12 09.2	1 43 41.8	.381 635	340.19261	.634 573	.24
16	9840.5	342 44 27.1	1 41 50.5	.382 185	342.72996	.634 069	.25
20	9844.5	345 16 35.9	1 39 47.4	.382 964	345.26488	.633 355	.26
24	9848.5	347 48 32.5	1 37 32.8	.383 971	347.79652	.632 431	.27
28	9852.5	350 20 14.1	-1 35 07.0	1.385 204	350.32406	0.631 306	+0.27
32	9856.5	352 51 37.6	-1 32 30.5	1.386 660	352.84670	0.629 981	+0.28

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
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JUPITER						
Jan.	0	243 9490.5	117° 48' 43.9"	+0° 23' 49.5"	5.253 009	117.81651 0.081 452
	10	9500.5	118 37 33.6	0 24 52.9	.256 532	118.63049 .081 343
	20	9510.5	119 26 19.4	0 25 56.0	.260 042	119.44338 .081 235
	30	9520.5	120 15 01.4	0 26 58.7	.263 538	120.25519 .081 127
Feb.	9	9530.5	121 03 39.5	0 28 01.0	.267 019	121.06593 .081 020
	19	9540.5	121 52 13.7	+0 29 02.8	5.270 484	121.87560 0.080 914
Mar.	1	9550.5	122 40 44.2	0 30 04.2	.273 933	122.68421 .080 808
	11	9560.5	123 29 10.8	0 31 05.2	.277 366	123.49176 .080 703
	21	9570.5	124 17 33.8	0 32 05.8	.280 780	124.29827 .080 599
	31	9580.5	125 05 53.0	0 33 05.9	.284 177	125.10374 .080 495
Apr.	10	9590.5	125 54 08.5	+0 34 05.5	5.287 555	125.90818 0.080 393
	20	9600.5	126 42 20.3	0 35 04.6	.290 914	126.71160 .080 291
	30	9610.5	127 30 28.5	0 36 03.3	.294 252	127.51400 .080 190
May	10	9620.5	128 18 33.1	0 37 01.4	.297 570	128.31540 .080 089
	20	9630.5	129 06 34.1	0 37 59.1	.300 866	129.11579 .079 990
	30	9640.5	129 54 31.6	+0 38 56.2	5.304 141	129.91520 0.079 891
June	9	9650.5	130 42 25.5	0 39 52.8	.307 393	130.71362 .079 793
	19	9660.5	131 30 16.0	0 40 48.9	.310 622	131.51107 .079 696
	29	9670.5	132 18 03.0	0 41 44.4	.313 827	132.30755 .079 600
July	9	9680.5	133 05 46.6	0 42 39.4	.317 008	133.10308 .079 505
	19	9690.5	133 53 26.8	+0 43 33.8	5.320 164	133.89766 0.079 411
	29	9700.5	134 41 03.7	0 44 27.7	.323 295	134.69131 .079 318
Aug.	8	9710.5	135 28 37.2	0 45 21.0	.326 399	135.48402 .079 226
	18	9720.5	136 16 07.4	0 46 13.7	.329 477	136.27582 .079 134
	28	9730.5	137 03 34.4	0 47 05.8	.332 528	137.06671 .079 044
Sept.	7	9740.5	137 50 58.2	+0 47 57.3	5.335 551	137.85670 0.078 954
	17	9750.5	138 38 18.8	0 48 48.2	.338 546	138.64580 .078 866
	27	9760.5	139 25 36.2	0 49 38.5	.341 512	139.43403 .078 778
Oct.	7	9770.5	140 12 50.5	0 50 28.2	.344 449	140.22138 .078 692
	17	9780.5	141 00 01.8	0 51 17.3	.347 356	141.00787 .078 606
	27	9790.5	141 47 10.0	+0 52 05.7	5.350 233	141.79351 0.078 522
Nov.	6	9800.5	142 34 15.2	0 52 53.5	.353 079	142.57831 .078 439
	16	9810.5	143 21 17.5	0 53 40.7	.355 893	143.36228 .078 356
	26	9820.5	144 08 16.8	0 54 27.2	.358 676	144.14544 .078 275
Dec.	6	9830.5	144 55 13.3	0 55 13.0	.361 427	144.92779 .078 195
	16	9840.5	145 42 06.9	+0 55 58.2	5.364 144	145.70934 0.078 116
	26	9850.5	146 28 57.6	0 56 42.7	.366 829	146.49011 .078 038
	36	9860.5	147 15 45.7	+0 57 26.6	5.369 479	147.27010 0.077 961

URANUS						
Dec.	21	9480.5	171 18 47.4	+0 45 57.8	18.285 68	171.31250 0.012 9532
Jan.	30	9520.5	171 49 52.9	0 45 54.5	.286 04	171.83064 .012 9537
Mar.	11	9560.5	172 20 58.4	0 45 50.9	.286 46	172.34880 .012 9541
Apr.	20	9600.5	172 52 04.0	0 45 47.2	.286 95	172.86696 .012 9543
May	30	9640.5	173 23 09.6	0 45 43.1	.287 49	173.38514 .012 9544
July	9	9680.5	173 54 15.1	+0 45 38.9	18.288 08	173.90332 0.012 9544
Aug.	18	9720.5	174 25 20.7	0 45 34.5	.288 74	174.42149 .012 9542
Sept.	27	9760.5	174 56 26.3	0 45 29.8	.289 46	174.93965 .012 9540
Nov.	6	9800.5	175 27 31.8	0 45 24.9	.290 23	175.45780 .012 9536
Dec.	16	9840.5	175 58 37.2	0 45 19.7	.291 06	175.97594 .012 9530
Jan.	25	9880.5	176 29 42.6	+0 45 14.4	18.291 95	176.49404 0.012 9524

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
 MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
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SATURN						
Jan.	0	243 9490.5	359° 41' 01.4	-2° 16' 41.8	9.531 334	359.70365 0.033 500
	10	9500.5	0 01 08.6	2 17 02.7	.528 257	0.03876 .033 521
	20	9510.5	0 21 16.5	2 17 23.4	.525 179	0.37407 .033 542
	30	9520.5	0 41 25.2	2 17 43.8	.522 101	0.70960 .033 563
Feb.	9	9530.5	1 01 34.6	2 18 03.9	.519 023	1.04534 .033 584
	19	9540.5	1 21 44.9	-2 18 23.8	9.515 945	1.38129 0.033 606
Mar.	1	9550.5	1 41 55.9	2 18 43.3	.512 867	1.71745 .033 627
	11	9560.5	2 02 07.7	2 19 02.7	.509 789	2.05383 .033 648
	21	9570.5	2 22 20.2	2 19 21.7	.506 711	2.39042 .033 669
	31	9580.5	2 42 33.6	2 19 40.4	.503 634	2.72722 .033 691
Apr.	10	9590.5	3 02 47.7	-2 19 58.9	9.500 558	3.06423 0.033 712
	20	9600.5	3 23 02.6	2 20 17.1	.497 482	3.40146 .033 733
	30	9610.5	3 43 18.2	2 20 35.0	.494 407	3.73890 .033 755
May	10	9620.5	4 03 34.7	2 20 52.7	.491 332	4.07655 .033 776
	20	9630.5	4 23 51.9	2 21 10.0	.488 259	4.41442 .033 797
	30	9640.5	4 44 09.9	-2 21 27.1	9.485 186	4.75250 0.033 819
June	9	9650.5	5 04 28.7	2 21 43.9	.482 115	5.09080 .033 840
	19	9660.5	5 24 48.3	2 22 00.4	.479 045	5.42931 .033 862
	29	9670.5	5 45 08.6	2 22 16.6	.475 977	5.76803 .033 883
July	9	9680.5	6 05 29.7	2 22 32.5	.472 909	6.10697 .033 905
	19	9690.5	6 25 51.6	-2 22 48.1	9.469 844	6.44613 0.033 926
	29	9700.5	6 46 14.3	2 23 03.5	.466 780	6.78550 .033 948
Aug.	8	9710.5	7 06 37.8	2 23 18.5	.463 718	7.12508 .033 969
	18	9720.5	7 27 02.1	2 23 33.3	.460 657	7.46488 .033 991
	28	9730.5	7 47 27.1	2 23 47.8	.457 599	7.80489 .034 012
Sept.	7	9740.5	8 07 52.9	-2 24 01.9	9.454 543	8.14512 0.034 034
	17	9750.5	8 28 19.5	2 24 15.8	.451 489	8.48557 .034 055
	27	9760.5	8 48 46.9	2 24 29.4	.448 437	8.82623 .034 077
Oct.	7	9770.5	9 09 15.1	2 24 42.7	.445 387	9.16711 .034 098
	17	9780.5	9 29 44.0	2 24 55.7	.442 341	9.50820 .034 120
	27	9790.5	9 50 13.8	-2 25 08.3	9.439 296	9.84951 0.034 142
Nov.	6	9800.5	10 10 44.3	2 25 20.7	.436 255	10.19103 .034 163
	16	9810.5	10 31 15.6	2 25 32.8	.433 216	10.53277 .034 185
	26	9820.5	10 51 47.7	2 25 44.6	.430 181	10.87472 .034 206
Dec.	6	9830.5	11 12 20.5	2 25 56.1	.427 148	11.21689 .034 228
	16	9840.5	11 32 54.2	-2 26 07.2	9.424 118	11.55928 0.034 249
	26	9850.5	11 53 28.6	2 26 18.1	.421 092	11.90188 .034 271
	36	9860.5	12 14 03.8	-2 26 28.7	9.418 069	12.24470 0.034 293
NEPTUNE						
Dec.	21	9480.5	232 07 57.7	+1 44 31.4	30.322 63	232.12766 0.005 9117
Jan.	30	9520.5	232 22 09.4	1 44 26.4	.322 70	232.36414 .005 9123
Mar.	11	9560.5	232 36 21.2	1 44 21.3	.322 76	232.60065 .005 9130
Apr.	20	9600.5	232 50 33.1	1 44 16.1	.322 83	232.83718 .005 9136
May	30	9640.5	233 04 45.0	1 44 10.9	.322 90	233.07373 .005 9143
July	9	9680.5	233 18 57.1	+1 44 05.4	30.322 97	233.31032 0.005 9149
Aug.	18	9720.5	233 33 09.3	1 43 59.9	.323 03	233.54693 .005 9156
Sept.	27	9760.5	233 47 21.6	1 43 54.3	.323 10	233.78357 .005 9163
Nov.	6	9800.5	234 01 33.9	1 43 48.6	.323 16	234.02023 .005 9170
Dec.	16	9840.5	234 15 46.4	1 43 42.8	.323 22	234.25692 .005 9176
Jan.	25	9880.5	234 29 58.9	+1 43 36.8	30.323 27	234.49364 0.005 9183

HELIOCENTRIC POSITIONS FOR 0^h EPHEMERIS TIME
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Longitude	Latitude	Radius Vector	Orbital Longitude	Daily Motion
	243					
Nov. 11	9440.5	168° 37' 15".9	+14° 46' 26".3	32.29529	169° 75898	0.005 7963
Jan. 30	9520.5	169 05 45.0	14 50 37.6	32.25035	170.22340	.005 8142
Apr. 20	9600.5	169 34 20.3	14 54 46.1	32.20565	170.68925	.005 8320
July 9	9680.5	170 03 01.8	14 58 51.8	32.16119	171.15651	.005 8496
Sept. 27	9760.5	170 31 49.3	+15 02 54.7	32.11697	171.62518	0.005 8671
Dec. 16	9840.5	171 00 42.8	15 06 54.8	32.07298	172.09525	.005 8844
Mar. 5	9920.5	171 29 42.3	+15 10 52.0	32.02924	172.56668	0.005 9015

INNER PLANETS
MEAN ELEMENTS
MEAN EQUINOX AND ECLIPTIC OF DATE

Planet	Epoch 1967 April 20.0 = J.D. 243 9600.5 ; variations for 100 days								
	Inclination		Longitude of		Mean	Mean	Eccentricity		
	<i>i</i>	Var.	Ascending Node Ω	Perihelion ϖ	Distance <i>a</i>	Motion <i>n</i>			
Mercury	7.00412	+1	47.94364	+325	76.94664	+426	0.387 099	4.092 339	0.205 628
Venus	3.39431	0	76.38541	+247	131.11097	+385	0.723 332	1.602 130	0.006 788
Mars	1.84989	0	49.30530	+211	335.45705	+504	1.523 691	0.524 033	0.093 375

Date	Julian Date	Mean Anomalies			Date	Julian Date	Mean Anomalies		
		Mercury	Venus	Mars			Mercury	Venus	Mars
	243					243			
Jan. 0	9490.5	163.749	177.530	182.580	July 9	9680.5	221.293	121.934	282.144
10	9500.5	204.673	193.551	187.820	19	9690.5	262.216	137.956	287.384
20	9510.5	245.596	209.572	193.060	29	9700.5	303.139	153.977	292.624
30	9520.5	286.519	225.594	198.300	Aug. 8	9710.5	344.063	169.998	297.864
Feb. 9	9530.5	327.443	241.615	203.541	18	9720.5	24.986	186.020	303.104
19	9540.5	8.366	257.636	208.781	28	9730.5	65.909	202.041	308.345
Mar. 1	9550.5	49.289	273.658	214.021	Sept. 7	9740.5	106.833	218.062	313.585
11	9560.5	90.213	289.679	219.261	17	9750.5	147.756	234.084	318.825
21	9570.5	131.136	305.700	224.501	27	9760.5	188.680	250.105	324.065
31	9580.5	172.059	321.721	229.742	Oct. 7	9770.5	229.603	266.126	329.305
Apr. 10	9590.5	212.983	337.743	234.982	17	9780.5	270.526	282.147	334.546
20	9600.5	253.906	353.764	240.222	27	9790.5	311.450	298.169	339.786
30	9610.5	294.829	9.785	245.462	Nov. 6	9800.5	352.373	314.190	345.026
May 10	9620.5	335.753	25.807	250.702	16	9810.5	33.296	330.211	350.266
20	9630.5	16.676	41.828	255.943	26	9820.5	74.220	346.233	355.507
30	9640.5	57.599	57.849	261.183	Dec. 6	9830.5	115.143	2.254	0.747
June 9	9650.5	98.523	73.871	266.423	16	9840.5	156.066	18.275	5.987
19	9660.5	139.446	89.892	271.663	26	9850.5	196.990	34.297	11.227
29	9670.5	180.369	105.913	276.903	36	9860.5	237.913	50.318	16.467

OSCULATING ELEMENTS
MEAN EQUINOX AND ECLIPTIC OF DATE

Date	Julian Date	Inclin- ation <i>i</i>	Longitude of Asc. Node Ω	Perihelion ϖ	Mean Distance <i>a</i>	Mean Motion <i>n</i>	Eccen- tricity <i>e</i>	Mean Anomaly
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JUPITER

	243							
Jan. 30	9520.5	1.30601	100.1156	13.5397	5.202 639	0.083 0952	0.048 2162	101.3701
Mar. 11	9560.5	1.30601	100.1166	13.5474	5.202 666	0.083 0945	0.048 2147	104.6878
Apr. 20	9600.5	1.30601	100.1176	13.5550	5.202 694	0.083 0939	0.048 2131	108.0054
May 30	9640.5	1.30601	100.1186	13.5626	5.202 721	0.083 0932	0.048 2113	111.3231
July 9	9680.5	1.30601	100.1196	13.5701	5.202 749	0.083 0925	0.048 2094	114.6407
Aug. 18	9720.5	1.30601	100.1206	13.5776	5.202 777	0.083 0919	0.048 2073	117.9584
Sept. 27	9760.5	1.30600	100.1216	13.5850	5.202 804	0.083 0912	0.048 2051	121.2761
Nov. 6	9800.5	1.30600	100.1226	13.5922	5.202 831	0.083 0906	0.048 2028	124.5939
Dec. 16	9840.5	1.30600	100.1237	13.5994	5.202 857	0.083 0899	0.048 2004	127.9118

SATURN

Jan. 30	9520.5	2.48876	113.4314	92.1316	9.538 109	0.033 4636	0.055 1870	274.9033
Mar. 11	9560.5	2.48875	113.4329	92.2553	9.536 961	0.033 4696	0.055 1596	276.1170
Apr. 20	9600.5	2.48875	113.4342	92.3756	9.535 836	0.033 4756	0.055 1278	277.3342
May 30	9640.5	2.48874	113.4354	92.4921	9.534 736	0.033 4814	0.055 0919	278.5551
July 9	9680.5	2.48873	113.4365	92.6048	9.533 660	0.033 4870	0.055 0520	279.7799
Aug. 18	9720.5	2.48872	113.4375	92.7134	9.532 610	0.033 4926	0.055 0083	281.0088
Sept. 27	9760.5	2.48871	113.4384	92.8178	9.531 587	0.033 4980	0.054 9612	282.2419
Nov. 6	9800.5	2.48870	113.4392	92.9178	9.530 590	0.033 5032	0.054 9107	283.4795
Dec. 16	9840.5	2.48868	113.4399	93.0133	9.529 621	0.033 5083	0.054 8573	284.7216

URANUS

Jan. 30	9520.5	0.77250	73.9167	168.9690	19.246 74	0.011 6729	0.049 9711	2.5861
Mar. 11	9560.5	0.77250	73.9189	169.0597	19.249 89	0.011 6700	0.050 1231	2.9715
Apr. 20	9600.5	0.77250	73.9208	169.1552	19.252 90	0.011 6673	0.050 2674	3.3525
May 30	9640.5	0.77250	73.9225	169.2549	19.255 77	0.011 6647	0.050 4037	3.7294
July 9	9680.5	0.77250	73.9239	169.3587	19.258 48	0.011 6622	0.050 5318	4.1026
Aug. 18	9720.5	0.77250	73.9251	169.4661	19.261 05	0.011 6599	0.050 6515	4.4724
Sept. 27	9760.5	0.77250	73.9261	169.5768	19.263 46	0.011 6577	0.050 7628	4.8392
Nov. 6	9800.5	0.77250	73.9268	169.6903	19.265 71	0.011 6556	0.050 8655	5.2033
Dec. 16	9840.5	0.77251	73.9273	169.8064	19.267 81	0.011 6537	0.050 9596	5.5650

NEPTUNE

Jan. 30	9520.5	1.77308	131.3933	55.4990	30.030 84	0.005 9891	0.009 7333	176.8037
Mar. 11	9560.5	1.77309	131.3917	55.8634	30.037 51	0.005 9871	0.009 5124	176.6748
Apr. 20	9600.5	1.77310	131.3902	56.2011	30.044 27	0.005 9851	0.009 2879	176.5732
May 30	9640.5	1.77310	131.3889	56.5100	30.051 12	0.005 9831	0.009 0604	176.5011
July 9	9680.5	1.77311	131.3877	56.7878	30.058 04	0.005 9810	0.008 8305	176.4608
Aug. 18	9720.5	1.77311	131.3867	57.0321	30.064 99	0.005 9789	0.008 5990	176.4545
Sept. 27	9760.5	1.77312	131.3858	57.2402	30.071 97	0.005 9769	0.008 3663	176.4852
Nov. 6	9800.5	1.77312	131.3852	57.4089	30.078 96	0.005 9748	0.008 1330	176.5559
Dec. 16	9840.5	1.77312	131.3847	57.5352	30.085 94	0.005 9727	0.007 8998	176.6696

PLUTO

Jan. 30	9520.5	17.12606	109.7683	222.8258	39.616 93	0.003 9526	0.249 8417	327.6558
Apr. 20	9600.5	17.12631	109.7729	222.7818	39.640 92	0.003 9490	0.250 2780	328.0351
July 9	9680.5	17.12675	109.7787	222.7486	39.663 12	0.003 9457	0.250 7003	328.4054
Sept. 27	9760.5	17.12736	109.7856	222.7261	39.683 37	0.003 9427	0.251 1041	328.7666
Dec. 16	9840.5	17.12812	109.7935	222.7142	39.701 50	0.003 9400	0.251 4853	329.1185

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Jan. 0	17 52 59.66 ^s	-24 09 15.1 ["]	2.39	6.30	1.395 723	11 18 26
1	17 59 45.13 ^s	24 16 05.8 ["]	2.38	6.28	.401 826 + 6 103	11 21 16
2	18 06 32.69 ^s	24 21 40.6 ["]	2.37	6.25	.407 379 5 553	11 24 08
3	18 13 22.21 ^s	24 25 58.0 ["]	2.36	6.23	.412 387 5 008	11 27 03
4	18 20 13.60 ^s	24 28 56.8 ["]	2.36	6.21	.416 852 4 465	11 29 59
						3 925
5	18 27 06.74 ^s	-24 30 35.8 ["]	2.35	6.19	1.420 777	11 32 56
6	18 34 01.53 ^s	24 30 53.8 ["]	2.35	6.18	.424 163 + 3 386	11 35 56
7	18 40 57.86 ^s	24 29 49.6 ["]	2.34	6.17	.427 009 2 846	11 38 57
8	18 47 55.62 ^s	24 27 22.3 ["]	2.34	6.16	.429 315 2 306	11 41 59
9	18 54 54.71 ^s	24 23 30.7 ["]	2.33	6.15	.431 078 1 763	11 45 02
						1 217
10	19 01 55.00 ^s	-24 18 13.9 ["]	2.33	6.14	1.432 295	11 48 07
11	19 08 56.40 ^s	24 11 31.0 ["]	2.33	6.14	.432 963 + 668	11 51 13
12	19 15 58.78 ^s	24 03 21.1 ["]	2.33	6.14	.433 075 + 112	11 54 19
13	19 23 02.03 ^s	23 53 43.3 ["]	2.33	6.14	.432 624 - 451	11 57 27
14	19 30 06.05 ^s	23 42 36.8 ["]	2.33	6.15	.431 604 1 020	12 00 35
						1 600
15	19 37 10.71 ^s	-23 30 00.8 ["]	2.34	6.15	1.430 004	12 03 44
16	19 44 15.90 ^s	23 15 54.8 ["]	2.34	6.16	.427 813 - 2 191	12 06 53
17	19 51 21.50 ^s	23 00 17.9 ["]	2.34	6.18	.425 019 2 794	12 10 03
18	19 58 27.40 ^s	22 43 09.7 ["]	2.35	6.19	.421 610 3 409	12 13 13
19	20 05 33.45 ^s	22 24 29.6 ["]	2.36	6.21	.417 568 4 042	12 16 23
						4 691
20	20 12 39.54 ^s	-22 04 17.3 ["]	2.36	6.23	1.412 877	12 19 33
21	20 19 45.51 ^s	21 42 32.4 ["]	2.37	6.25	.407 519 - 5 358	12 22 42
22	20 26 51.22 ^s	21 19 14.8 ["]	2.38	6.28	.401 473 6 046	12 25 52
23	20 33 56.51 ^s	20 54 24.4 ["]	2.39	6.31	.394 717 6 756	12 29 00
24	20 41 01.19 ^s	20 28 01.2 ["]	2.41	6.34	.387 227 7 490	12 32 09
						8 250
25	20 48 05.08 ^s	-20 00 05.6 ["]	2.42	6.38	1.378 977	12 35 16
26	20 55 07.95 ^s	19 30 38.0 ["]	2.44	6.42	.369 940 - 9 037	12 38 22
27	21 02 09.56 ^s	18 59 39.2 ["]	2.46	6.47	.360 087 9 853	12 41 27
28	21 09 09.64 ^s	18 27 10.1 ["]	2.48	6.52	.349 388 10 699	12 44 30
29	21 16 07.88 ^s	17 53 12.2 ["]	2.50	6.58	.337 812 11 576	12 47 31
						12 485
30	21 23 03.92 ^s	-17 17 47.3 ["]	2.52	6.64	1.325 327	12 50 29
31	21 29 57.35 ^s	16 40 57.7 ["]	2.55	6.71	.311 900 - 13 427	12 53 25
Feb. 1	21 36 47.69 ^s	16 02 46.2 ["]	2.57	6.78	.297 499 14 401	12 56 17
2	21 43 34.40 ^s	15 23 16.6 ["]	2.61	6.86	.282 095 15 404	12 59 05
3	21 50 16.84 ^s	14 42 33.2 ["]	2.64	6.95	.265 659 16 436	13 01 49
						17 492
4	21 56 54.28 ^s	-14 00 41.5 ["]	2.68	7.05	1.248 167	13 04 27
5	22 03 25.85 ^s	13 17 47.8 ["]	2.72	7.16	.229 600 - 18 567	13 06 59
6	22 09 50.59 ^s	12 34 00.0 ["]	2.76	7.27	.209 946 19 654	13 09 23
7	22 16 07.39 ^s	11 49 27.0 ["]	2.81	7.40	.189 203 20 743	13 11 38
8	22 22 14.95 ^s	11 04 19.4 ["]	2.86	7.54	.167 380 21 823	13 13 44
						22 881
9	22 28 11.88 ^s	-10 18 49.3 ["]	2.92	7.69	1.144 499	13 15 38
10	22 33 56.57 ^s	9 33 11.0 ["]	2.98	7.85	.120 599 - 23 900	13 17 19
11	22 39 27.25 ^s	8 47 40.1 ["]	3.05	8.03	.095 739 24 860	13 18 44
12	22 44 42.01 ^s	8 02 34.1 ["]	3.12	8.22	.069 996 25 743	13 19 53
13	22 49 38.78 ^s	7 18 12.7 ["]	3.20	8.43	.043 473 26 523	13 20 42
						27 179
14	22 54 15.38 ^s	- 6 34 56.9 ["]	3.29	8.66	1.016 294	13 21 10
15	22 58 29.52 ^s	- 5 53 09.3 ["]	3.38	8.90	.988 606 - 27 688	13 21 14

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ^{''}	^{''}	^{''}		^h ^m ^s
Feb. 15	22 58 29.52 +229.38	5 53 09.3 +2395.6	3.38	8.90	0.988 606	13 21 14
16	23 02 18.90 202.33	5 13 13.7 2259.0	3.48	9.16	.960 579	13 20 52
17	23 05 41.23 173.10	4 35 34.7 2097.6	3.58	9.44	.932 403	13 20 02
18	23 08 34.33 141.82	4 00 37.1 1911.4	3.69	9.73	.904 284	13 18 41
19	23 10 56.15 108.80	3 28 45.7 1701.2	3.81	10.04	.876 442	13 16 49
20	23 12 44.95 +74.36	3 00 24.5 +1468.7	3.93	10.36	0.849 102	13 14 22
21	23 13 59.31 38.97	2 35 55.8 1215.7	4.06	10.70	.822 494	13 11 21
22	23 14 38.28 +3.17	2 15 40.1 945.6	4.19	11.04	.796 844	13 07 44
23	23 14 41.45 -32.41	1 59 54.5 661.8	4.32	11.39	.772 371	13 03 32
24	23 14 09.04 67.05	1 48 52.7 369.0	4.46	11.74	.749 280	12 58 45
25	23 13 01.99 -99.99	1 42 43.7 +72.6	4.59	12.09	0.727 760	12 53 25
26	23 11 22.00 130.43	1 41 31.1 -221.3	4.72	12.43	.707 976	12 47 33
27	23 09 11.57 157.62	1 45 12.4 506.1	4.84	12.75	.690 070	12 41 13
28	23 06 33.95 180.81	1 53 38.5 775.1	4.95	13.05	.674 156	12 34 28
Mar. 1	23 03 33.14 199.42	2 06 33.6 1021.8	5.06	13.33	.660 318	12 27 22
2	23 00 13.72 -212.97	2 23 35.4 -1239.9	5.15	13.57	0.648 609	12 20 01
3	22 56 40.75 221.22	2 44 15.3 1424.9	5.23	13.77	.639 049	12 12 29
4	22 52 59.53 224.07	3 08 00.2 1572.6	5.29	13.93	.631 628	12 04 51
5	22 49 15.46 221.71	3 34 12.8 1681.4	5.33	14.05	.626 308	11 57 14
6	22 45 33.75 214.44	4 02 14.2 1751.0	5.36	14.12	.623 021	11 49 41
7	22 41 59.31 -202.77	4 31 25.2 -1782.5	5.37	14.16	0.621 680	11 42 18
8	22 38 36.54 187.31	5 01 07.7 1778.7	5.37	14.14	.622 177	11 35 07
9	22 35 29.23 168.73	5 30 46.4 1743.3	5.35	14.09	.624 390	11 28 14
10	22 32 40.50 147.73	5 59 49.7 1680.5	5.32	14.01	.628 190	11 21 40
11	22 30 12.77 124.98	6 27 50.2 1594.9	5.27	13.89	.633 440	11 15 28
12	22 28 07.79 -101.09	6 54 25.1 -1491.1	5.22	13.75	0.640 004	11 09 39
13	22 26 26.70 76.62	7 19 16.2 1373.1	5.16	13.59	.647 748	11 04 14
14	22 25 10.08 52.02	7 42 09.3 1244.9	5.09	13.40	.656 543	10 59 13
15	22 24 18.06 27.70	8 02 54.2 1109.6	5.01	13.21	.666 267	10 54 37
16	22 23 50.36 -3.92	8 21 23.8 969.9	4.93	13.00	.676 806	10 50 24
17	22 23 46.44 +19.07	8 37 33.7 -828.2	4.85	12.79	0.688 055	10 46 35
18	22 24 05.51 41.11	8 51 21.9 686.1	4.77	12.57	.699 917	10 43 08
19	22 24 46.62 62.10	9 02 48.0 544.9	4.69	12.35	.712 307	10 40 02
20	22 25 48.72 82.00	9 11 52.9 405.8	4.61	12.14	.725 145	10 37 17
21	22 27 10.72 100.75	9 18 38.7 269.2	4.52	11.92	.738 364	10 34 51
22	22 28 51.47 +118.39	9 23 07.9 -135.7	4.44	11.70	0.751 902	10 32 43
23	22 30 49.86 134.91	9 25 23.6 -5.7	4.36	11.49	.765 704	10 30 53
24	22 33 04.77 150.38	9 25 29.3 +120.8	4.28	11.29	.779 722	10 29 18
25	22 35 35.15 164.83	9 23 28.5 243.8	4.21	11.08	.793 916	10 27 58
26	22 38 19.98 178.33	9 19 24.7 362.9	4.13	10.89	.808 247	10 26 53
27	22 41 18.31 +190.93	9 13 21.8 +478.8	4.06	10.70	0.822 685	10 26 00
28	22 44 29.24 202.70	9 05 23.0 590.9	3.99	10.51	.837 201	10 25 20
29	22 47 51.94 213.68	8 55 32.1 699.8	3.92	10.33	.851 771	10 24 51
30	22 51 25.62 223.94	8 43 52.3 805.3	3.86	10.16	.866 375	10 24 32
31	22 55 09.56 233.55	8 30 27.0 907.7	3.79	9.99	.880 993	10 24 24
Apr. 1	22 59 03.11 +242.56	8 15 19.3 +1007.1	3.73	9.83	0.895 610	10 24 25
2	23 03 05.67	7 58 32.2	3.67	9.67	0.910 212	10 24 35

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	"	"		^h ^m ^s
Apr. 1	22 59 03.11	- 8 15 19.3	3.73	9.83	0.895 610	10 24 25
2	23 03 05.67	7 58 32.2	3.67	9.67	.910 212	10 24 35
3	23 07 16.68	7 40 08.6	3.61	9.52	.924 788	10 24 53
4	23 11 35.66	7 20 11.2	3.56	9.37	.939 326	10 25 18
5	23 16 02.16	6 58 42.7	3.50	9.23	.953 818	10 25 52
6	23 20 35.78	- 6 35 45.5	3.45	9.09	0.968 256	10 26 32
7	23 25 16.19	6 11 22.0	3.40	8.96	.982 632	10 27 18
8	23 30 03.07	5 45 34.5	3.35	8.83	0.996 939	10 28 11
9	23 34 56.16	5 18 25.3	3.30	8.70	1.011 171	10 29 11
10	23 39 55.25	4 49 56.3	3.26	8.58	.025 321	10 30 16
11	23 45 00.14	- 4 20 09.6	3.21	8.47	1.039 383	10 31 27
12	23 50 10.70	3 49 07.2	3.17	8.35	.053 350	10 32 43
13	23 55 26.79	3 16 50.9	3.13	8.25	.067 214	10 34 05
14	0 00 48.33	2 43 22.8	3.09	8.14	.080 969	10 35 33
15	0 06 15.28	2 08 44.5	3.05	8.04	.094 605	10 37 06
16	0 11 47.61	- 1 32 57.9	3.01	7.94	1.108 112	10 38 44
17	0 17 25.32	0 56 04.9	2.98	7.85	.121 480	10 40 27
18	0 23 08.45	- 0 18 07.3	2.94	7.76	.134 696	10 42 17
19	0 28 57.05	+ 0 20 53.2	2.91	7.67	.147 746	10 44 11
20	0 34 51.22	1 00 54.4	2.88	7.58	.160 614	10 46 12
21	0 40 51.06	+ 1 41 54.6	2.85	7.50	1.173 281	10 48 18
22	0 46 56.72	2 23 51.6	2.82	7.42	.185 726	10 50 30
23	0 53 08.34	3 06 43.3	2.79	7.35	.197 926	10 52 48
24	0 59 26.12	3 50 27.4	2.76	7.27	.209 853	10 55 12
25	1 05 50.26	4 35 01.4	2.73	7.20	.221 477	10 57 43
26	1 12 20.97	+ 5 20 22.5	2.71	7.14	1.232 762	11 00 20
27	1 18 58.47	6 06 27.7	2.69	7.08	.243 671	11 03 05
28	1 25 43.01	6 53 13.8	2.66	7.02	.254 160	11 05 56
29	1 32 34.82	7 40 37.0	2.64	6.96	.264 181	11 08 56
30	1 39 34.14	8 28 33.2	2.62	6.91	.273 683	11 12 02
May 1	1 46 41.21	+ 9 16 57.6	2.60	6.86	1.282 607	11 15 17
2	1 53 56.25	10 05 45.2	2.59	6.82	.290 890	11 18 40
3	2 01 19.46	10 54 50.1	2.57	6.78	.298 467	11 22 11
4	2 08 50.99	11 44 05.9	2.56	6.74	.305 265	11 25 50
5	2 16 30.98	12 33 25.2	2.55	6.71	.311 210	11 29 38
6	2 24 19.48	+13 22 40.0	2.54	6.69	1.316 223	11 33 35
7	2 32 16.46	14 11 41.5	2.53	6.67	.320 225	11 37 40
8	2 40 21.84	15 00 20.2	2.52	6.65	.323 138	11 41 54
9	2 48 35.38	15 48 25.3	2.52	6.64	.324 883	11 46 16
10	2 56 56.75	16 35 46.0	2.52	6.64	.325 390	11 50 45
11	3 05 25.50	+17 22 10.2	2.52	6.64	1.324 593	11 55 21
12	3 14 01.01	18 07 25.9	2.53	6.65	.322 438	12 00 04
13	3 22 42.53	18 51 20.7	2.53	6.67	.318 882	12 04 53
14	3 31 29.16	19 33 42.1	2.54	6.70	.313 901	12 09 46
15	3 40 19.87	20 14 18.2	2.55	6.73	.307 483	12 14 43
16	3 49 13.54	+20 52 57.5	2.57	6.77	1.299 639	12 19 42
17	3 58 08.93	+21 29 29.6	2.59	6.82	1.290 398	12 24 43

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] [″]	[″]	[″]		^h ^m ^s
May 17	3 58 08.93	+21 29 29.6	2.59	6.82	1.290 398	12 24 43
18	4 07 04.73	22 03 45.2	2.61	6.88	.279 806	12 29 42
19	4 15 59.63	22 35 36.7	2.63	6.94	.267 928	12 34 41
20	4 24 52.28	23 04 57.6	2.66	7.01	.254 843	12 39 36
21	4 33 41.38	23 31 43.6	2.69	7.09	.240 642	12 44 27
22	4 42 25.66	+23 55 51.7	2.73	7.18	1.225 423	12 49 13
23	4 51 03.93	24 17 20.6	2.76	7.28	.209 294	12 53 52
24	4 59 35.07	24 36 10.6	2.80	7.38	.192 361	12 58 23
25	5 07 58.07	24 52 23.3	2.84	7.49	.174 732	13 02 45
26	5 16 12.00	25 06 01.5	2.89	7.61	.156 512	13 06 58
27	5 24 16.01	+25 17 09.0	2.94	7.73	1.137 802	13 11 01
28	5 32 09.37	25 25 50.3	2.99	7.87	.118 697	13 14 52
29	5 39 51.42	25 32 10.8	3.04	8.01	.099 285	13 18 31
30	5 47 21.59	25 36 16.1	3.09	8.15	.079 648	13 21 59
31	5 54 39.35	25 38 12.6	3.15	8.30	.059 860	13 25 13
June 1	6 01 44.25	+25 38 06.5	3.21	8.46	1.039 989	13 28 15
2	6 08 35.89	25 36 04.5	3.27	8.63	.020 094	13 31 02
3	6 15 13.90	25 32 13.2	3.34	8.80	1.000 231	13 33 36
4	6 21 37.94	25 26 39.6	3.41	8.98	0.980 448	13 35 56
5	6 27 47.71	25 19 30.1	3.48	9.16	.960 789	13 38 01
6	6 33 42.91	+25 10 51.7	3.55	9.35	0.941 292	13 39 51
7	6 39 23.25	25 00 50.8	3.62	9.54	.921 993	13 41 27
8	6 44 48.48	24 49 34.2	3.70	9.75	.902 922	13 42 47
9	6 49 58.29	24 37 08.3	3.78	9.95	.884 109	13 43 51
10	6 54 52.42	24 23 39.5	3.86	10.17	.865 580	13 44 40
11	6 59 30.58	+24 09 14.2	3.94	10.39	0.847 359	13 45 12
12	7 03 52.48	23 53 58.7	4.03	10.61	.829 470	13 45 28
13	7 07 57.82	23 37 59.1	4.11	10.84	.811 934	13 45 27
14	7 11 46.28	23 21 21.6	4.20	11.07	.794 773	13 45 09
15	7 15 17.55	23 04 12.3	4.29	11.31	.778 010	13 44 34
16	7 18 31.32	+22 46 37.2	4.39	11.55	0.761 665	13 43 41
17	7 21 27.25	22 28 42.4	4.48	11.80	.745 761	13 42 30
18	7 24 05.04	22 10 33.9	4.57	12.05	.730 321	13 41 01
19	7 26 24.37	21 52 17.5	4.67	12.30	.715 369	13 39 13
20	7 28 24.96	21 33 59.4	4.77	12.55	.700 930	13 37 06
21	7 30 06.53	+21 15 45.6	4.86	12.81	0.687 031	13 34 41
22	7 31 28.86	20 57 41.8	4.96	13.06	.673 700	13 31 56
23	7 32 31.77	20 39 54.0	5.05	13.31	.660 967	13 28 52
24	7 33 15.15	20 22 28.1	5.15	13.56	.648 864	13 25 28
25	7 33 38.97	20 05 29.9	5.24	13.81	.637 425	13 21 45
26	7 33 43.32	+19 49 05.0	5.33	14.04	0.626 683	13 17 43
27	7 33 28.39	19 33 19.0	5.42	14.27	.616 677	13 13 22
28	7 32 54.53	19 18 17.5	5.50	14.49	.607 445	13 08 42
29	7 32 02.27	19 04 05.6	5.58	14.69	.599 027	13 03 44
30	7 30 52.32	18 50 48.4	5.65	14.88	.591 464	12 58 30
July 1	7 29 25.58	+18 38 30.8	5.71	15.05	0.584 797	12 52 59
2	7 27 43.22	+18 27 17.2	5.77	15.20	0.579 069	12 47 14

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
July	^{h m s}	^{° ′ ″}	[″]	[″]		^{h m s}
1	7 29 25.58 ^s	+18 38 30.8 [″]	5.71	15.05	0.584 797	12 52 59
2	7 27 43.22 ^s	18 27 17.2 [″]	5.77	15.20	.579 069	12 47 14
3	7 25 46.59 ^s	18 17 11.7 [″]	5.82	15.32	.574 320	12 41 15
4	7 23 37.32 ^s	18 08 18.0 [″]	5.85	15.42	.570 591	12 35 05
5	7 21 17.26 ^s	18 00 39.2 [″]	5.88	15.50	.567 921	12 28 45
6	7 18 48.48 ^s	+17 54 17.9 [″]	5.90	15.54	0.566 345	12 22 18
7	7 16 13.23 ^s	17 49 16.1 [″]	5.90	15.55	.565 897	12 15 46
8	7 13 33.96 ^s	17 45 35.3 [″]	5.89	15.53	.566 606	12 09 11
9	7 10 53.21 ^s	17 43 16.0 [″]	5.88	15.48	.568 497	12 02 35
10	7 08 13.62 ^s	17 42 18.1 [″]	5.84	15.40	.571 591	11 56 02
11	7 05 37.84 ^s	+17 42 40.9 [″]	5.80	15.28	0.575 901	11 49 35
12	7 03 08.52 ^s	17 44 22.9 [″]	5.74	15.13	.581 440	11 43 15
13	7 00 48.21 ^s	17 47 21.7 [″]	5.68	14.96	.588 210	11 37 05
14	6 58 39.36 ^s	17 51 34.3 [″]	5.60	14.76	.596 212	11 31 07
15	6 56 44.28 ^s	17 56 57.2 [″]	5.52	14.53	.605 438	11 25 24
16	6 55 05.05 ^s	+18 03 25.7 [″]	5.42	14.29	0.615 878	11 19 58
17	6 53 43.58 ^s	18 10 54.9 [″]	5.32	14.02	.627 517	11 14 50
18	6 52 41.53 ^s	18 19 19.2 [″]	5.22	13.74	.640 333	11 10 02
19	6 52 00.34 ^s	18 28 32.1 [″]	5.10	13.45	.654 303	11 05 35
20	6 51 41.23 ^s	18 38 27.1 [″]	4.99	13.15	.669 398	11 01 31
21	6 51 45.20 ^s	+18 48 56.6 [″]	4.87	12.84	0.685 587	10 57 49
22	6 52 13.05 ^s	18 59 53.0 [″]	4.75	12.52	.702 833	10 54 32
23	6 53 05.41 ^s	19 11 07.9 [″]	4.63	12.20	.721 099	10 51 40
24	6 54 22.72 ^s	19 22 32.6 [″]	4.51	11.89	.740 341	10 49 12
25	6 56 05.27 ^s	19 33 58.0 [″]	4.39	11.57	.760 512	10 47 10
26	6 58 13.24 ^s	+19 45 14.6 [″]	4.27	11.26	0.781 562	10 45 33
27	7 00 46.68 ^s	19 56 12.4 [″]	4.16	10.95	.803 433	10 44 21
28	7 03 45.50 ^s	20 06 41.4 [″]	4.04	10.65	.826 065	10 43 34
29	7 07 09.56 ^s	20 16 30.7 [″]	3.93	10.36	.849 389	10 43 13
30	7 10 58.56 ^s	20 25 29.5 [″]	3.82	10.08	.873 331	10 43 17
31	7 15 12.13 ^s	+20 33 26.9 [″]	3.72	9.80	0.897 808	10 43 45
Aug. 1	7 19 49.78 ^s	20 40 11.4 [″]	3.62	9.54	.922 729	10 44 36
2	7 24 50.92 ^s	20 45 31.7 [″]	3.52	9.28	.947 994	10 45 51
3	7 30 14.79 ^s	20 49 16.6 [″]	3.43	9.04	.973 495	10 47 28
4	7 36 00.55 ^s	20 51 14.7 [″]	3.34	8.81	0.999 114	10 49 27
5	7 42 07.15 ^s	+20 51 15.6 [″]	3.26	8.59	1.024 723	10 51 47
6	7 48 33.44 ^s	20 49 09.0 [″]	3.18	8.38	.050 190	10 54 25
7	7 55 18.08 ^s	20 44 45.8 [″]	3.11	8.18	.075 376	10 57 22
8	8 02 19.56 ^s	20 37 57.9 [″]	3.04	8.00	.100 139	11 00 34
9	8 09 36.26 ^s	20 28 38.7 [″]	2.97	7.83	.124 337	11 04 01
10	8 17 06.40 ^s	+20 16 43.1 [″]	2.91	7.67	1.147 830	11 07 41
11	8 24 48.11 ^s	20 02 07.8 [″]	2.85	7.52	.170 486	11 11 31
12	8 32 39.44 ^s	19 44 51.6 [″]	2.80	7.38	.192 183	11 15 31
13	8 40 38.43 ^s	19 24 55.1 [″]	2.75	7.26	.212 812	11 19 37
14	8 48 43.13 ^s	19 02 21.0 [″]	2.71	7.14	.232 282	11 23 47
15	8 56 51.63 ^s	+18 37 13.8 [″]	2.67	7.04	1.250 517	11 28 01
16	9 05 02.13 ^s	+18 09 39.6 [″]	2.64	6.94	1.267 465	11 32 16

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	9 05 02.13	+18 09 39.6	2.64	6.94	1.267 465	11 32 16
17	9 13 12.97	17 39 46.0	2.60	6.86	.283 088	11 36 31
18	9 21 22.64	17 07 41.5	2.57	6.78	.297 372	11 40 44
19	9 29 29.81	16 33 35.5	2.55	6.72	.310 315	11 44 53
20	9 37 33.34	15 57 37.8	2.53	6.66	.321 933	11 48 59
21	9 45 32.27	+15 19 58.7	2.51	6.61	1.332 255	11 52 59
22	9 53 25.81	14 40 48.1	2.49	6.56	.341 319	11 56 54
23	10 01 13.37	14 00 16.0	2.48	6.52	.349 170	12 00 43
24	10 08 54.47	13 18 32.0	2.46	6.49	.355 859	12 04 24
25	10 16 28.80	12 35 45.2	2.45	6.46	.361 440	12 07 59
26	10 23 56.15	+11 52 04.1	2.45	6.44	1.365 971	12 11 27
27	10 31 16.41	11 07 36.9	2.44	6.43	.369 507	12 14 48
28	10 38 29.57	10 22 30.9	2.43	6.41	.372 103	12 18 01
29	10 45 35.65	9 36 53.0	2.43	6.41	.373 814	12 21 07
30	10 52 34.78	8 50 49.5	2.43	6.40	.374 690	12 24 07
31	10 59 27.07	+ 8 04 26.2	2.43	6.40	1.374 780	12 26 59
Sept. 1	11 06 12.72	7 17 48.3	2.43	6.40	.374 130	12 29 45
2	11 12 51.92	6 31 00.7	2.43	6.41	.372 780	12 32 25
3	11 19 24.88	5 44 07.8	2.44	6.42	.370 771	12 34 59
4	11 25 51.83	4 57 13.5	2.44	6.43	.368 136	12 37 26
5	11 32 12.99	+ 4 10 21.5	2.45	6.45	1.364 911	12 39 48
6	11 38 28.61	3 23 35.2	2.45	6.47	.361 122	12 42 04
7	11 44 38.92	2 36 57.5	2.46	6.49	.356 798	12 44 16
8	11 50 44.15	1 50 31.4	2.47	6.51	.351 961	12 46 22
9	11 56 44.51	1 04 19.3	2.48	6.53	.346 635	12 48 23
10	12 02 40.22	+ 0 18 23.7	2.49	6.56	1.340 838	12 50 20
11	12 08 31.49	- 0 27 13.1	2.50	6.59	.334 587	12 52 13
12	12 14 18.51	1 12 29.2	2.52	6.63	.327 898	12 54 01
13	12 20 01.45	1 57 22.4	2.53	6.66	.320 783	12 55 46
14	12 25 40.48	2 41 51.1	2.54	6.70	.313 254	12 57 26
15	12 31 15.76	- 3 25 53.3	2.56	6.74	1.305 320	12 59 03
16	12 36 47.43	4 09 27.4	2.58	6.78	.296 991	13 00 36
17	12 42 15.62	4 52 31.8	2.59	6.83	.288 273	13 02 06
18	12 47 40.44	5 35 05.0	2.61	6.88	.279 172	13 03 33
19	12 53 01.97	6 17 05.3	2.63	6.93	.269 692	13 04 56
20	12 58 20.30	- 6 58 31.2	2.65	6.99	1.259 838	13 06 16
21	13 03 35.48	7 39 21.2	2.67	7.04	.249 611	13 07 33
22	13 08 47.56	8 19 33.8	2.70	7.10	.239 014	13 08 47
23	13 13 56.54	8 59 07.2	2.72	7.17	.228 048	13 09 58
24	13 19 02.41	9 38 00.1	2.75	7.23	.216 714	13 11 06
25	13 24 05.14	-10 16 10.6	2.77	7.30	1.205 011	13 12 10
26	13 29 04.66	10 53 37.1	2.80	7.38	.192 940	13 13 11
27	13 34 00.88	11 30 17.6	2.83	7.45	.180 499	13 14 09
28	13 38 53.67	12 06 10.4	2.86	7.54	.167 689	13 15 03
29	13 43 42.88	12 41 13.5	2.89	7.62	.154 508	13 15 54
30	13 48 28.29	-13 15 24.5	2.93	7.71	1.140 956	13 16 41
Oct. 1	13 53 09.66	-13 48 41.3	2.96	7.81	1.127 032	13 17 23

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	13 53 09.66 ^s	-13 48 41.3	2.96	7.81	1.127 032	13 17 23
2	13 57 46.70 ^{+277.04}	14 21 01.4 ^{-1940.1}	3.00	7.91	1.12 737 ^{-14 295}	13 18 01
3	14 02 19.06 ^{272.36}	14 52 22.2 ^{1880.8}	3.04	8.01	0.98 072 ^{14 665}	13 18 34
4	14 06 46.34 ^{267.28}	15 22 40.7 ^{1818.5}	3.08	8.13	0.83 038 ^{15 034}	13 19 02
5	14 11 08.07 ^{261.73}	15 51 53.8 ^{1753.1}	3.13	8.24	0.67 639 ^{15 399}	13 19 24
	^{255.63}	^{1684.4}			^{15 761}	
6	14 15 23.70	-16 19 58.2	3.18	8.37	1.051 878	13 19 39
7	14 19 32.61 ^{+248.91}	16 46 50.2 ^{-1612.0}	3.22	8.50	0.35 763 ^{-16 115}	13 19 48
8	14 23 34.10 ^{241.49}	17 12 25.6 ^{1535.4}	3.28	8.63	0.19 302 ^{16 461}	13 19 48
9	14 27 27.35 ^{233.25}	17 36 39.9 ^{1454.3}	3.33	8.78	1.002 509 ^{16 793}	13 19 40
10	14 31 11.45 ^{224.10}	17 59 28.2 ^{1368.3}	3.39	8.93	0.985 397 ^{17 112}	13 19 22
	^{213.93}	^{1276.8}			^{17 411}	
11	14 34 45.38	-18 20 45.0	3.45	9.09	0.967 986	13 18 53
12	14 38 07.97 ^{+202.59}	18 40 24.2 ^{-1179.2}	3.51	9.26	0.950 301 ^{-17 685}	13 18 12
13	14 41 17.97 ^{190.00}	18 58 19.0 ^{1074.8}	3.58	9.44	0.932 372 ^{17 929}	13 17 18
14	14 44 13.94 ^{175.97}	19 14 21.8 ^{962.8}	3.65	9.63	0.914 234 ^{18 138}	13 16 09
15	14 46 54.31 ^{160.37}	19 28 24.3 ^{842.5}	3.73	9.82	0.895 934 ^{18 300}	13 14 44
	^{143.07}	^{712.9}			^{18 410}	
16	14 49 17.38	-19 40 17.2	3.81	10.03	0.877 524	13 13 00
17	14 51 21.30 ^{+123.92}	19 49 49.9 ^{-572.7}	3.89	10.24	0.859 070 ^{-18 454}	13 10 56
18	14 53 04.06 ^{102.76}	19 56 51.2 ^{421.3}	3.97	10.47	0.840 649 ^{18 421}	13 08 30
19	14 54 23.59 ^{79.53}	20 01 08.2 ^{257.0}	4.06	10.70	0.822 353 ^{18 296}	13 05 40
20	14 55 17.72 ^{54.13}	20 02 27.4 ^{-79.2}	4.15	10.94	0.804 291 ^{18 062}	13 02 23
	^{+26.58}	^{+113.5}			^{17 702}	
21	14 55 44.30	-20 00 33.9	4.25	11.19	0.786 589	12 58 38
22	14 55 41.26 ^{-3.04}	19 55 12.6 ^{+321.3}	4.34	11.44	0.769 394 ^{-17 195}	12 54 22
23	14 55 06.72 ^{34.54}	19 46 07.8 ^{544.8}	4.44	11.69	0.752 875 ^{16 519}	12 49 35
24	14 53 59.18 ^{67.54}	19 33 04.6 ^{783.2}	4.53	11.94	0.737 223 ^{15 652}	12 44 14
25	14 52 17.67 ^{101.51}	19 15 50.2 ^{1034.4}	4.62	12.18	0.722 651 ^{14 572}	12 38 19
	^{135.67}	^{1295.5}			^{13 257}	
26	14 50 02.00	-18 54 14.7	4.71	12.40	0.709 394	12 31 51
27	14 47 12.99 ^{-169.01}	18 28 14.0 ^{+1560.7}	4.79	12.61	0.697 703 ^{-11 691}	12 24 51
28	14 43 52.66 ^{200.33}	17 57 51.6 ^{1822.4}	4.86	12.79	0.687 841 ^{9 862}	12 17 21
29	14 40 04.46 ^{228.20}	17 23 21.2 ^{2070.4}	4.91	12.94	0.680 071 ^{7 770}	12 09 27
30	14 35 53.30 ^{251.16}	16 45 08.7 ^{2292.5}	4.95	13.04	0.674 648 ^{5 423}	12 01 13
	^{267.75}	^{2475.2}			^{2 846}	
31	14 31 25.55	-16 03 53.5	4.97	13.10	0.671 802	11 52 46
Nov. 1	14 26 48.82 ^{-276.73}	15 20 28.7 ^{+2604.8}	4.97	13.10	0.671 724 ⁻⁷⁸	11 44 14
2	14 22 11.56 ^{277.26}	14 35 59.0 ^{2669.7}	4.95	13.05	0.674 553 ^{+2 829}	11 35 47
3	14 17 42.60 ^{268.96}	13 51 37.3 ^{2661.7}	4.91	12.93	0.680 360 ^{5 807}	11 27 31
4	14 13 30.57 ^{252.03}	13 08 39.7 ^{2577.6}	4.85	12.77	0.689 143 ^{8 783}	11 19 36
	^{227.27}	^{2420.4}			^{11 681}	
5	14 09 43.30	-12 28 19.3	4.77	12.56	0.700 824	11 12 08
6	14 06 27.42 ^{-195.88}	11 51 41.9 ^{+2197.4}	4.67	12.30	0.715 249 ^{+14 425}	11 05 14
7	14 03 48.03 ^{159.39}	11 19 40.8 ^{1921.1}	4.56	12.02	0.732 205 ^{16 956}	10 58 58
8	14 01 48.55 ^{119.48}	10 52 54.9 ^{1605.9}	4.44	11.71	0.751 425 ^{19 220}	10 53 22
9	14 00 30.79 ^{77.76}	10 31 47.6 ^{1267.3}	4.32	11.39	0.772 608 ^{21 183}	10 48 28
	^{-35.67}	^{919.5}			^{22 823}	
10	13 59 55.12	-10 16 28.1	4.20	11.06	0.795 431	10 44 15
11	14 00 00.67 ^{+5.55}	10 06 52.9 ^{+575.2}	4.08	10.74	0.819 570 ^{+24 139}	10 40 42
12	14 00 45.64 ^{44.97}	10 02 48.8 ^{+244.1}	3.95	10.42	0.844 705 ^{25 135}	10 37 48
13	14 02 07.59 ^{81.95}	10 03 54.9 ^{-66.1}	3.84	10.11	0.870 537 ^{25 832}	10 35 29
14	14 04 03.68 ^{116.09}	10 09 45.9 ^{351.0}	3.72	9.81	0.896 788 ^{26 251}	10 33 43
	^{147.20}	^{607.6}			^{26 425}	
15	14 06 30.88	-10 19 53.5	3.62	9.53	0.923 213	10 32 26
16	14 09 26.10 ^{+175.22}	-10 33 48.6 ^{-835.1}	3.52	9.27	0.949 596 ^{+26 383}	10 31 36

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	14 09 26.10	-10 33 48.6	3.52	9.27	0.949 596	10 31 36
17	14 12 46.36	10 51 02.2	3.42	9.02	0.975 753	10 31 10
18	14 16 28.87	11 11 06.6	3.33	8.79	1.001 529	10 31 05
19	14 20 31.02	11 33 35.7	3.25	8.57	.026 799	10 31 18
20	14 24 50.47	11 58 05.5	3.18	8.37	.051 461	10 31 48
21	14 29 25.11	-12 24 14.1	3.11	8.18	1.075 438	10 32 32
22	14 34 13.08	12 51 41.9	3.04	8.01	.098 670	10 33 29
23	14 39 12.77	13 20 11.4	2.98	7.85	.121 115	10 34 37
24	14 44 22.75	13 49 27.1	2.92	7.70	.142 742	10 35 55
25	14 49 41.80	14 19 15.0	2.87	7.56	.163 534	10 37 21
26	14 55 08.87	-14 49 23.2	2.82	7.44	1.183 481	10 38 55
27	15 00 43.07	15 19 40.8	2.78	7.32	.202 582	10 40 35
28	15 06 23.62	15 49 58.6	2.74	7.21	.220 840	10 42 22
29	15 12 09.87	16 20 08.2	2.70	7.11	.238 263	10 44 14
30	15 18 01.27	16 50 02.5	2.66	7.01	.254 863	10 46 11
Dec. 1	15 23 57.34	-17 19 35.0	2.63	6.93	1.270 653	10 48 13
2	15 29 57.68	17 48 40.1	2.60	6.84	.285 650	10 50 19
3	15 36 01.96	18 17 12.7	2.57	6.77	.299 869	10 52 29
4	15 42 09.89	18 45 08.4	2.54	6.70	.313 328	10 54 42
5	15 48 21.21	19 12 23.1	2.52	6.64	.326 043	10 56 58
6	15 54 35.73	-19 38 53.3	2.50	6.58	1.338 034	10 59 18
7	16 00 53.28	20 04 35.8	2.48	6.52	.349 315	11 01 40
8	16 07 13.70	20 29 27.5	2.46	6.47	.359 905	11 04 06
9	16 13 36.88	20 53 25.9	2.44	6.42	.369 818	11 06 34
10	16 20 02.72	21 16 28.5	2.42	6.38	.379 069	11 09 05
11	16 26 31.11	-21 38 33.0	2.41	6.34	1.387 673	11 11 38
12	16 33 01.98	21 59 37.3	2.39	6.31	.395 642	11 14 14
13	16 39 35.26	22 19 39.4	2.38	6.27	.402 989	11 16 52
14	16 46 10.88	22 38 37.5	2.37	6.24	.409 724	11 19 32
15	16 52 48.78	22 56 29.7	2.36	6.22	.415 859	11 22 15
16	16 59 28.90	-23 13 14.6	2.35	6.19	1.421 400	11 25 00
17	17 06 11.18	23 28 50.4	2.34	6.17	.426 357	11 27 47
18	17 12 55.56	23 43 15.5	2.33	6.15	.430 737	11 30 36
19	17 19 41.99	23 56 28.5	2.33	6.13	.434 545	11 33 27
20	17 26 30.39	24 08 28.0	2.32	6.12	.437 785	11 36 20
21	17 33 20.72	-24 19 12.4	2.32	6.11	1.440 462	11 39 15
22	17 40 12.90	24 28 40.5	2.32	6.10	.442 578	11 42 12
23	17 47 06.85	24 36 50.9	2.31	6.09	.444 134	11 45 11
24	17 54 02.51	24 43 42.2	2.31	6.09	.445 130	11 48 11
25	18 00 59.80	24 49 13.2	2.31	6.09	.445 566	11 51 13
26	18 07 58.63	-24 53 22.6	2.31	6.09	1.445 439	11 54 16
27	18 14 58.90	24 56 09.2	2.31	6.09	.444 746	11 57 21
28	18 22 00.52	24 57 31.8	2.31	6.10	.443 484	12 00 27
29	18 29 03.39	24 57 29.4	2.32	6.10	.441 645	12 03 34
30	18 36 07.37	24 56 00.7	2.32	6.11	.439 225	12 06 43
31	18 43 12.36	-24 53 04.7	2.33	6.13	1.436 215	12 09 52
32	18 50 18.20	24 48 40.5	2.33	6.14	1.432 606	12 13 02

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Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Jan.	0	19 33 31.41		-22 54 04.8			5.08	5.32	1.655 039			12 58 25
	1	19 38 54.87	+323.46	22 43 25.7		+ 639.1	5.09	5.32	.652 890	- 2 149		12 59 52
	2	19 44 17.43	322.56	22 32 05.3		680.4	5.09	5.33	.650 704	2 186		13 01 17
	3	19 49 39.03	321.60	22 20 03.9		721.4	5.10	5.34	.648 482	2 222		13 02 42
	4	19 54 59.64	320.61	22 07 22.2		761.7	5.11	5.35	.646 224	2 258		13 04 06
			319.59			801.7				2 296		
	5	20 00 19.23		-21 54 00.5			5.12	5.35	1.643 928			13 05 28
	6	20 05 37.75	+318.52	21 39 59.5		+ 841.0	5.12	5.36	.641 594	- 2 334		13 06 50
	7	20 10 55.18	317.43	21 25 19.7		879.8	5.13	5.37	.639 223	2 371		13 08 10
	8	20 16 11.47	316.29	21 10 01.8		917.9	5.14	5.38	.636 814	2 409		13 09 29
	9	20 21 26.60	315.13	20 54 06.3		955.5	5.15	5.38	.634 367	2 447		13 10 47
			313.93			992.5				2 487		
	10	20 26 40.53		-20 37 33.8			5.15	5.39	1.631 880			13 12 04
	11	20 31 53.24	+312.71	20 20 25.2		+1028.6	5.16	5.40	.629 356	- 2 524		13 13 19
	12	20 37 04.71	311.47	20 02 41.0		1064.2	5.17	5.41	.626 792	2 564		13 14 34
	13	20 42 14.90	310.19	19 44 21.8		1099.2	5.18	5.42	.624 189	2 603		13 15 47
	14	20 47 23.81	308.91	19 25 28.5		1133.3	5.19	5.43	.621 548	2 641		13 16 58
			307.61			1166.7				2 680		
	15	20 52 31.42		-19 06 01.8			5.19	5.44	1.618 868			13 18 09
	16	20 57 37.72	+306.30	18 46 02.2		+1199.6	5.20	5.45	.616 149	- 2 719		13 19 18
	17	21 02 42.70	304.98	18 25 30.7		1231.5	5.21	5.45	.613 391	2 758		13 20 26
	18	21 07 46.36	303.66	18 04 27.8		1262.9	5.22	5.46	.610 595	2 796		13 21 32
	19	21 12 48.70	302.34	17 42 54.5		1293.3	5.23	5.47	.607 760	2 835		13 22 37
			301.01			1323.1				2 873		
	20	21 17 49.71		-17 20 51.4			5.24	5.48	1.604 887			13 23 41
	21	21 22 49.40	+299.69	16 58 19.3		+1352.1	5.25	5.49	.601 975	- 2 912		13 24 43
	22	21 27 47.77	298.37	16 35 19.0		1380.3	5.26	5.50	.599 026	2 949		13 25 44
	23	21 32 44.83	297.06	16 11 51.3		1407.7	5.27	5.51	.596 038	2 988		13 26 44
	24	21 37 40.60	295.77	15 47 56.9		1434.4	5.28	5.52	.593 013	3 025		13 27 43
			294.48			1460.2				3 063		
	25	21 42 35.08		-15 23 36.7			5.29	5.53	1.589 950			13 28 40
	26	21 47 28.29	+293.21	14 58 51.5		+1485.2	5.30	5.55	.586 850	- 3 100		13 29 36
	27	21 52 20.24	291.95	14 33 41.9		1509.6	5.31	5.56	.583 713	3 137		13 30 31
	28	21 57 10.95	290.71	14 08 08.9		1533.0	5.32	5.57	.580 538	3 175		13 31 24
	29	22 02 00.45	289.50	13 42 13.1		1555.8	5.33	5.58	.577 325	3 213		13 32 17
			288.31			1577.8				3 250		
	30	22 06 48.76		-13 15 55.3			5.34	5.59	1.574 075			13 33 08
	31	22 11 35.91	+287.15	12 49 16.3		+1599.0	5.35	5.60	.570 788	- 3 287		13 33 58
Feb.	1	22 16 21.93	286.02	12 22 16.9		1619.4	5.37	5.61	.567 462	3 326		13 34 47
	2	22 21 06.84	284.91	11 54 57.8		1639.1	5.38	5.63	.564 097	3 365		13 35 34
	3	22 25 50.68	283.84	11 27 19.8		1658.0	5.39	5.64	.560 694	3 403		13 36 21
			282.79			1676.2				3 443		
	4	22 30 33.47		-10 59 23.6			5.40	5.65	1.557 251			13 37 07
	5	22 35 15.24	+281.77	10 31 10.1		+1693.5	5.41	5.66	.553 768	- 3 483		13 37 51
	6	22 39 56.02	280.78	10 02 40.1		1710.0	5.42	5.68	.550 245	3 523		13 38 35
	7	22 44 35.85	279.83	9 33 54.4		1725.7	5.44	5.69	.546 681	3 564		13 39 18
	8	22 49 14.74	278.89	9 04 53.7		1740.7	5.45	5.70	.543 076	3 605		13 40 00
			278.00			1754.9				3 646		
	9	22 53 52.74		- 8 35 38.8			5.46	5.72	1.539 430			13 40 40
	10	22 58 29.87	+277.13	8 06 10.5		+1768.3	5.48	5.73	.535 743	- 3 687		13 41 21
	11	23 03 06.17	276.30	7 36 29.7		1780.8	5.49	5.74	.532 014	3 729		13 42 00
	12	23 07 41.68	275.51	7 06 37.0		1792.7	5.50	5.76	.528 242	3 772		13 42 39
	13	23 12 16.43	274.75	6 36 33.3		1803.7	5.52	5.77	.524 429	3 813		13 43 16
			274.03			1814.1				3 855		
	14	23 16 50.46		- 6 06 19.2			5.53	5.79	1.520 574			13 43 53
	15	23 21 23.81	+273.35	5 35 55.7		+1823.5	5.55	5.80	1.516 677	- 3 897		13 44 30

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	23 21 23.81 +272.70	- 5 35 55.7 +1832.2	5.55	5.80	1.516 677	13 44 30
16	23 25 56.51 272.10	5 05 23.5 1840.2	5.56	5.82	.512 737 - 3 940	13 45 06
17	23 30 28.61 271.53	4 34 43.3 1847.4	5.57	5.83	.508 756 3 981	13 45 41
18	23 35 00.14 271.01	4 03 55.9 1853.9	5.59	5.85	.504 732 4 024	13 46 16
19	23 39 31.15 270.51	3 33 02.0 1859.5	5.60	5.86	.500 666 4 066	13 46 50
20	23 44 01.66 +270.07	- 3 02 02.5 +1864.5	5.62	5.88	1.496 558 - 4 150	13 47 23
21	23 48 31.73 269.66	2 30 58.0 1868.6	5.64	5.90	.492 408 4 192	13 47 57
22	23 53 01.39 269.29	1 59 49.4 1872.0	5.65	5.91	.488 216 4 233	13 48 30
23	23 57 30.68 268.97	1 28 37.4 1874.6	5.67	5.93	.483 983 4 274	13 49 02
24	0 01 59.65 268.68	0 57 22.8 1876.6	5.68	5.95	.479 709 4 315	13 49 34
25	0 06 28.33 +268.44	- 0 26 06.2 +1877.9	5.70	5.96	1.475 394 - 4 357	13 50 06
26	0 10 56.77 268.26	+ 0 05 11.7 1878.3	5.72	5.98	.471 037 4 398	13 50 38
27	0 15 25.03 268.11	0 36 30.0 1878.2	5.73	6.00	.466 639 4 439	13 51 10
28	0 19 53.14 268.01	1 07 48.2 1877.3	5.75	6.02	.462 200 4 481	13 51 41
Mar. 1	0 24 21.15 267.95	1 39 05.5 1875.7	5.77	6.04	.457 719 4 522	13 52 13
2	0 28 49.10 +267.94	+ 2 10 21.2 +1873.4	5.79	6.06	1.453 197 - 4 565	13 52 44
3	0 33 17.04 267.98	2 41 34.6 1870.3	5.81	6.07	.448 632 4 607	13 53 16
4	0 37 45.02 268.04	3 12 44.9 1866.7	5.82	6.09	.444 025 4 650	13 53 47
5	0 42 13.06 268.15	3 43 51.6 1862.1	5.84	6.11	.439 375 4 694	13 54 19
6	0 46 41.21 268.31	4 14 53.7 1856.9	5.86	6.13	.434 681 4 737	13 54 50
7	0 51 09.52 +268.49	+ 4 45 50.6 +1850.9	5.88	6.15	1.429 944 - 4 781	13 55 22
8	0 55 38.01 268.71	5 16 41.5 1844.3	5.90	6.17	.425 163 4 825	13 55 54
9	1 00 06.72 268.98	5 47 25.8 1836.8	5.92	6.20	.420 338 4 870	13 56 26
10	1 04 35.70 269.28	6 18 02.6 1828.6	5.94	6.22	.415 468 4 915	13 56 59
11	1 09 04.98 269.62	6 48 31.2 1819.6	5.96	6.24	.410 553 4 960	13 57 32
12	1 13 34.60 +269.99	+ 7 18 50.8 +1810.0	5.98	6.26	1.405 593 - 5 005	13 58 05
13	1 18 04.59 270.40	7 49 00.8 1799.6	6.00	6.28	.400 588 5 051	13 58 39
14	1 22 34.99 270.84	8 19 00.4 1788.5	6.03	6.31	.395 537 5 095	13 59 13
15	1 27 05.83 271.32	8 48 48.9 1776.5	6.05	6.33	.390 442 5 142	13 59 48
16	1 31 37.15 271.84	9 18 25.4 1764.0	6.07	6.35	.385 300 5 186	14 00 23
17	1 36 08.99 +272.37	+ 9 47 49.4 +1750.5	6.09	6.38	1.380 114 - 5 232	14 00 58
18	1 40 41.36 272.94	10 16 59.9 1736.4	6.12	6.40	.374 882 5 277	14 01 35
19	1 45 14.30 273.55	10 45 56.3 1721.6	6.14	6.43	.369 605 5 323	14 02 11
20	1 49 47.85 274.16	11 14 37.9 1705.9	6.16	6.45	.364 282 5 367	14 02 49
21	1 54 22.01 274.82	11 43 03.8 1689.6	6.19	6.48	.358 915 5 412	14 03 27
22	1 58 56.83 +275.50	+12 11 13.4 +1672.4	6.21	6.50	1.353 503 - 5 457	14 04 05
23	2 03 32.33 276.20	12 39 05.8 1654.6	6.24	6.53	.348 046 5 500	14 04 45
24	2 08 08.53 276.93	13 06 40.4 1636.0	6.26	6.55	.342 546 5 544	14 05 25
25	2 12 45.46 277.68	13 33 56.4 1616.8	6.29	6.58	.337 002 5 588	14 06 06
26	2 17 23.14 278.47	14 00 53.2 1596.7	6.32	6.61	.331 414 5 630	14 06 47
27	2 22 01.61 +279.27	+14 27 29.9 +1576.1	6.34	6.64	1.325 784 - 5 674	14 07 30
28	2 26 40.88 280.10	14 53 46.0 1554.7	6.37	6.67	.320 110 5 716	14 08 13
29	2 31 20.98 280.96	15 19 40.7 1532.6	6.40	6.70	.314 394 5 758	14 08 57
30	2 36 01.94 281.82	15 45 13.3 1509.9	6.43	6.72	.308 636 5 802	14 09 42
31	2 40 43.76 282.71	16 10 23.2 1486.5	6.46	6.75	.302 834 5 844	14 10 28
Apr. 1	2 45 26.47 +283.61	+16 35 09.7 +1462.2	6.48	6.78	1.296 990 - 5 887	14 11 14
2	2 50 10.08	+16 59 31.9	6.51	6.82	1.291 103	14 12 02

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]	["]	^h ^m ^s
Apr. 1	2 45 26.47 +283.61	+16 35 09.7 +1462.2	6.48	6.78	1.296 990 - 5 887	14 11 14
2	2 50 10.08 284.51	16 59 31.9 1437.5	6.51	6.82	.291 103 5 931	14 12 02
3	2 54 54.59 285.43	17 23 29.4 1411.8	6.54	6.85	.285 172 5 973	14 12 51
4	2 59 40.02 286.35	17 47 01.2 1385.6	6.57	6.88	.279 199 6 017	14 13 40
5	3 04 26.37 287.27	18 10 06.8 1358.7	6.61	6.91	.273 182 6 061	14 14 30
6	3 09 13.64 +288.20	+18 32 45.5 +1330.9	6.64	6.94	1.267 121 - 6 104	14 15 22
7	3 14 01.84 289.13	18 54 56.4 1302.7	6.67	6.98	.261 017 6 148	14 16 14
8	3 18 50.97 290.04	19 16 39.1 1273.6	6.70	7.01	.254 869 6 191	14 17 07
9	3 23 41.01 290.96	19 37 52.7 1243.9	6.74	7.05	.248 678 6 236	14 18 01
10	3 28 31.97 291.87	19 58 36.6 1213.6	6.77	7.08	.242 442 6 279	14 18 56
11	3 33 23.84 +292.76	+20 18 50.2 +1182.7	6.80	7.12	1.236 163 - 6 322	14 19 52
12	3 38 16.60 293.63	20 38 32.9 1150.9	6.84	7.16	.229 841 6 366	14 20 49
13	3 43 10.23 294.50	20 57 43.8 1118.8	6.87	7.19	.223 475 6 409	14 21 47
14	3 48 04.73 295.33	21 16 22.6 1085.9	6.91	7.23	.217 066 6 453	14 22 45
15	3 53 00.06 296.14	21 34 28.5 1052.4	6.95	7.27	.210 613 6 495	14 23 44
16	3 57 56.20 +296.92	+21 52 00.9 +1018.5	6.98	7.31	1.204 118 - 6 538	14 24 44
17	4 02 53.12 297.68	22 08 59.4 983.8	7.02	7.35	.197 580 6 580	14 25 45
18	4 07 50.80 298.39	22 25 23.2 948.7	7.06	7.39	.191 000 6 621	14 26 47
19	4 12 49.19 299.07	22 41 11.9 913.0	7.10	7.43	.184 379 6 663	14 27 49
20	4 17 48.26 299.71	22 56 24.9 876.8	7.14	7.47	.177 716 6 704	14 28 52
21	4 22 47.97 +300.32	+23 11 01.7 +840.2	7.18	7.51	1.171 012 - 6 743	14 29 56
22	4 27 48.29 300.88	23 25 01.9 803.0	7.22	7.56	.164 269 6 782	14 31 00
23	4 32 49.17 301.41	23 38 24.9 765.5	7.27	7.60	.157 487 6 822	14 32 04
24	4 37 50.58 301.89	23 51 10.4 727.5	7.31	7.65	.150 665 6 859	14 33 10
25	4 42 52.47 302.33	24 03 17.9 689.3	7.35	7.69	.143 806 6 896	14 34 15
26	4 47 54.80 +302.73	+24 14 47.2 +650.6	7.40	7.74	1.136 910 - 6 933	14 35 21
27	4 52 57.53 303.08	24 25 37.8 611.7	7.44	7.79	.129 977 6 969	14 36 28
28	4 58 00.61 303.36	24 35 49.5 572.4	7.49	7.84	.123 008 7 006	14 37 35
29	5 03 03.97 303.60	24 45 21.9 532.9	7.54	7.89	.116 002 7 042	14 38 42
30	5 08 07.57 303.79	24 54 14.8 493.2	7.58	7.94	.108 960 7 077	14 39 49
May 1	5 13 11.36 +303.91	+25 02 28.0 +453.1	7.63	7.99	1.101 883 - 7 112	14 40 56
2	5 18 15.27 303.96	25 10 01.1 412.9	7.68	8.04	.094 771 7 147	14 42 04
3	5 23 19.23 303.96	25 16 54.0 372.5	7.73	8.09	.087 624 7 183	14 43 11
4	5 28 23.19 303.91	25 23 06.5 332.0	7.78	8.14	.080 441 7 217	14 44 18
5	5 33 27.10 303.76	25 28 38.5 291.3	7.84	8.20	.073 224 7 252	14 45 26
6	5 38 30.86 +303.57	+25 33 29.8 +250.5	7.89	8.26	1.065 972 - 7 286	14 46 33
7	5 43 34.43 303.30	25 37 40.3 209.8	7.94	8.31	.058 686 7 320	14 47 40
8	5 48 37.73 302.97	25 41 10.1 168.9	8.00	8.37	.051 366 7 354	14 48 47
9	5 53 40.70 302.55	25 43 59.0 128.1	8.06	8.43	.044 012 7 386	14 49 53
10	5 58 43.25 302.07	25 46 07.1 87.4	8.11	8.49	.036 626 7 420	14 50 59
11	6 03 45.32 +301.51	+25 47 34.5 +46.6	8.17	8.55	1.029 206 - 7 453	14 52 04
12	6 08 46.83 300.87	25 48 21.1 6.1	8.23	8.61	.021 753 7 485	14 53 08
13	6 13 47.70 300.16	25 48 27.2 - 34.3	8.29	8.68	.014 268 7 516	14 54 12
14	6 18 47.86 299.37	25 47 52.9 74.6	8.35	8.74	1.006 752 7 547	14 55 15
15	6 23 47.23 298.49	25 46 38.3 114.6	8.42	8.81	0.999 205 7 578	14 56 18
16	6 28 45.72 +297.55	+25 44 43.7 - 154.4	8.48	8.87	0.991 627 - 7 608	14 57 19
17	6 33 43.27	+25 42 09.3	8.55	8.94	0.984 019	14 58 20

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	6 33 43.27	+25 42 09.3	8.55	8.94	0.984 019	14 58 20
18	6 38 39.80	25 38 55.3	8.61	9.01	.976 382	14 59 19
19	6 43 35.23	25 35 02.1	8.68	9.08	.968 717	15 00 17
20	6 48 29.48	25 30 30.0	8.75	9.16	.961 025	15 01 14
21	6 53 22.50	25 25 19.4	8.82	9.23	.953 307	15 02 10
22	6 58 14.22	+25 19 30.5	8.89	9.31	0.945 563	15 03 04
23	7 03 04.56	25 13 04.0	8.97	9.38	.937 795	15 03 57
24	7 07 53.46	25 06 00.2	9.04	9.46	.930 004	15 04 48
25	7 12 40.87	24 58 19.6	9.12	9.54	.922 190	15 05 38
26	7 17 26.73	24 50 02.8	9.20	9.62	.914 356	15 06 27
27	7 22 10.97	+24 41 10.2	9.28	9.71	0.906 500	15 07 13
28	7 26 53.54	24 31 42.3	9.36	9.79	.898 625	15 07 58
29	7 31 34.37	24 21 39.7	9.44	9.88	.890 731	15 08 42
30	7 36 13.43	24 11 03.0	9.53	9.97	.882 818	15 09 23
31	7 40 50.66	23 59 52.8	9.61	10.06	.874 887	15 10 02
June 1	7 45 26.00	+23 48 09.6	9.70	10.15	0.866 939	15 10 40
2	7 49 59.41	23 35 54.0	9.79	10.24	.858 974	15 11 16
3	7 54 30.84	23 23 06.8	9.88	10.34	.850 993	15 11 49
4	7 59 00.23	23 09 48.5	9.98	10.44	.842 997	15 12 21
5	8 03 27.54	22 55 59.8	10.07	10.54	.834 986	15 12 50
6	8 07 52.74	+22 41 41.4	10.17	10.64	0.826 960	15 13 17
7	8 12 15.75	22 26 54.0	10.27	10.75	.818 921	15 13 42
8	8 16 36.55	22 11 38.4	10.37	10.85	.810 869	15 14 05
9	8 20 55.08	21 55 55.2	10.48	10.96	.802 805	15 14 26
10	8 25 11.30	21 39 45.2	10.58	11.07	.794 729	15 14 44
11	8 29 25.16	+21 23 09.3	10.69	11.19	0.786 642	15 15 00
12	8 33 36.61	21 06 08.2	10.80	11.30	.778 545	15 15 13
13	8 37 45.60	20 48 42.6	10.92	11.42	.770 439	15 15 24
14	8 41 52.10	20 30 53.3	11.03	11.54	.762 325	15 15 32
15	8 45 56.03	20 12 41.3	11.15	11.67	.754 205	15 15 38
16	8 49 57.38	+19 54 07.3	11.27	11.80	0.746 078	15 15 41
17	8 53 56.09	19 35 12.2	11.40	11.92	.737 947	15 15 42
18	8 57 52.11	19 15 56.8	11.52	12.06	.729 813	15 15 39
19	9 01 45.42	18 56 21.9	11.65	12.19	.721 677	15 15 34
20	9 05 35.96	18 36 28.4	11.79	12.33	.713 541	15 15 26
21	9 09 23.70	+18 16 17.2	11.92	12.48	0.705 406	15 15 16
22	9 13 08.60	17 55 49.1	12.06	12.62	.697 275	15 15 02
23	9 16 50.61	17 35 05.1	12.20	12.77	.689 147	15 14 46
24	9 20 29.70	17 14 05.8	12.35	12.92	.681 026	15 14 27
25	9 24 05.82	16 52 52.3	12.50	13.08	.672 912	15 14 04
26	9 27 38.93	+16 31 25.4	12.65	13.24	0.664 806	15 13 39
27	9 31 09.00	16 09 45.8	12.81	13.40	.656 711	15 13 10
28	9 34 35.97	15 47 54.6	12.97	13.57	.648 626	15 12 39
29	9 37 59.80	15 25 52.3	13.13	13.74	.640 555	15 12 04
30	9 41 20.44	15 03 40.2	13.30	13.91	.632 497	15 11 26
July 1	9 44 37.85	+14 41 19.0	13.47	14.09	0.624 455	15 10 45
2	9 47 51.96	+14 18 49.4	13.64	14.28	0.616 429	15 10 01

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	9 44 37.85	+14 41 19.0	13.47	14.09	0.624 455	15 10 45
2	9 47 51.96	14 18 49.4	13.64	14.28	.616 429	15 10 01
3	9 51 02.71	13 56 12.6	13.82	14.46	.608 421	15 09 13
4	9 54 10.04	13 33 29.5	14.01	14.66	.600 433	15 08 21
5	9 57 13.89	13 10 40.9	14.19	14.85	.592 466	15 07 26
6	10 00 14.17	+12 47 47.8	14.39	15.06	0.584 522	15 06 28
7	10 03 10.82	12 24 51.3	14.59	15.26	.576 601	15 05 26
8	10 06 03.75	12 01 52.3	14.79	15.47	.568 707	15 04 20
9	10 08 52.88	11 38 51.9	15.00	15.69	.560 840	15 03 10
10	10 11 38.09	11 15 51.2	15.21	15.91	.553 803	15 01 56
11	10 14 19.29	+10 52 51.3	15.43	16.14	0.545 197	15 00 38
12	10 16 56.37	10 29 53.1	15.65	16.37	.537 424	14 59 16
13	10 19 29.21	10 06 58.1	15.88	16.61	.529 688	14 57 50
14	10 21 57.72	9 44 07.3	16.11	16.86	.521 990	14 56 19
15	10 24 21.75	9 21 21.9	16.35	17.11	.514 333	14 54 44
16	10 26 41.18	+ 8 58 43.3	16.60	17.37	0.506 721	14 53 04
17	10 28 55.88	8 36 12.6	16.85	17.63	.499 156	14 51 19
18	10 31 05.71	8 13 51.3	17.11	17.90	.491 641	14 49 29
19	10 33 10.54	7 51 40.6	17.37	18.18	.484 180	14 47 35
20	10 35 10.21	7 29 42.0	17.64	18.46	.476 777	14 45 35
21	10 37 04.57	+ 7 07 56.8	17.92	18.75	0.469 435	14 43 29
22	10 38 53.47	6 46 26.5	18.20	19.04	.462 157	14 41 19
23	10 40 36.76	6 25 12.6	18.49	19.34	.454 948	14 39 02
24	10 42 14.26	6 04 16.6	18.78	19.65	.447 812	14 36 40
25	10 43 45.82	5 43 39.9	19.08	19.97	.440 752	14 34 11
26	10 45 11.26	+ 5 23 24.3	19.39	20.29	0.433 773	14 31 36
27	10 46 30.42	5 03 31.4	19.70	20.61	.426 880	14 28 55
28	10 47 43.10	4 44 02.9	20.02	20.95	.420 075	14 26 08
29	10 48 49.15	4 25 00.5	20.35	21.29	.413 365	14 23 14
30	10 49 48.35	4 06 26.1	20.68	21.63	.406 754	14 20 13
31	10 50 40.55	+ 3 48 21.8	21.01	21.99	0.400 246	14 17 04
Aug. 1	10 51 25.55	3 30 49.4	21.35	22.34	.393 848	14 13 49
2	10 52 03.16	3 13 51.0	21.70	22.71	.387 564	14 10 26
3	10 52 33.20	2 57 28.8	22.05	23.07	.381 400	14 06 55
4	10 52 55.50	2 41 44.8	22.41	23.44	.375 362	14 03 17
5	10 53 09.89	+ 2 26 41.6	22.76	23.82	0.369 456	13 59 31
6	10 53 16.20	2 12 21.3	23.12	24.20	.363 689	13 55 36
7	10 53 14.29	1 58 46.4	23.49	24.58	.358 066	13 51 34
8	10 53 04.01	1 45 59.3	23.85	24.96	.352 595	13 47 23
9	10 52 45.26	1 34 02.6	24.22	25.34	.347 283	13 43 03
10	10 52 17.94	+ 1 22 58.7	24.58	25.72	0.342 137	13 38 35
11	10 51 41.99	1 12 50.2	24.94	26.10	.337 166	13 33 59
12	10 50 57.39	1 03 39.4	25.30	26.48	.332 377	13 29 14
13	10 50 04.16	0 55 28.8	25.66	26.85	.327 779	13 24 20
14	10 49 02.37	0 48 20.6	26.01	27.21	.323 380	13 19 18
15	10 47 52.12	+ 0 42 16.9	26.35	27.57	0.319 188	13 14 08
16	10 46 33.58	+ 0 37 19.7	26.68	27.92	0.315 213	13 08 50

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	10 46 33.58 - 86.57	+ 0 37 19.7 - 229.3	26.68	27.92	0.315 213 - 3 750	13 08 50
17	10 45 07.01 94.34	0 33 30.4 159.8	27.00	28.25	.311 463 - 3 518	13 03 23
18	10 43 32.67 101.72	0 30 50.6 89.2	27.31	28.58	.307 945 3 276	12 57 50
19	10 41 50.95 108.70	0 29 21.4 - 18.4	27.60	28.88	.304 669 3 028	12 52 09
20	10 40 02.25 115.15	0 29 03.0 + 52.9	27.88	29.17	.301 641 2 771	12 46 22
21	10 38 07.10 - 121.06	+ 0 29 55.9 + 124.0	28.14	29.44	0.298 870 - 2 508	12 40 28
22	10 36 06.04 126.33	0 31 59.9 194.3	28.38	29.69	.296 362 2 239	12 34 29
23	10 33 59.71 130.93	0 35 14.2 263.4	28.59	29.92	.294 123 1 964	12 28 25
24	10 31 48.78 134.77	0 39 37.6 330.7	28.79	30.12	.292 159 1 684	12 22 17
25	10 29 34.01 137.84	0 45 08.3 395.9	28.95	30.30	.290 475 1 400	12 16 06
26	10 27 16.17 - 140.08	+ 0 51 44.2 + 458.4	29.09	30.44	0.289 075 - 1 113	12 09 52
27	10 24 56.09 141.47	0 59 22.6 517.7	29.21	30.56	.287 962 822	12 03 36
28	10 22 34.62 141.98	1 08 00.3 573.2	29.29	30.65	.287 140 531	11 57 19
29	10 20 12.64 141.60	1 17 33.5 625.0	29.34	30.70	.286 609 - 239	11 51 03
30	10 17 51.04 140.35	1 27 58.5 672.0	29.37	30.73	.286 370 + 54	11 44 47
31	10 15 30.69 - 138.20	+ 1 39 10.5 + 714.4	29.36	30.72	0.286 424 + 345	11 38 32
Sept. 1	10 13 12.49 135.23	1 51 04.9 751.8	29.33	30.69	.286 769 633	11 32 20
2	10 10 57.26 131.44	2 03 36.7 784.3	29.26	30.62	.287 402 920	11 26 12
3	10 08 45.82 126.87	2 16 41.0 811.4	29.17	30.52	.288 322 1 202	11 20 08
4	10 06 38.95 121.58	2 30 12.4 833.2	29.05	30.39	.289 524 1 480	11 14 08
5	10 04 37.37 - 115.60	+ 2 44 05.6 + 849.7	28.90	30.24	0.291 004 + 1 753	11 08 14
6	10 02 41.77 109.00	2 58 15.3 861.3	28.73	30.06	.292 757 2 022	11 02 26
7	10 00 52.77 101.86	3 12 36.6 867.7	28.53	29.85	.294 779 2 283	10 56 45
8	9 59 10.91 94.21	3 27 04.3 869.0	28.31	29.62	.297 062 2 539	10 51 12
9	9 57 36.70 86.11	3 41 33.3 866.1	28.07	29.37	.299 601 2 788	10 45 46
10	9 56 10.59 - 77.63	+ 3 55 59.4 + 858.4	27.81	29.10	0.302 389 + 3 029	10 40 28
11	9 54 52.96 68.84	4 10 17.8 846.3	27.54	28.81	.305 418 3 263	10 35 19
12	9 53 44.12 59.81	4 24 24.1 830.7	27.24	28.51	.308 681 3 490	10 30 18
13	9 52 44.31 50.57	4 38 14.8 811.1	26.94	28.19	.312 171 3 709	10 25 27
14	9 51 53.74 41.18	4 51 45.9 788.2	26.62	27.86	.315 880 3 918	10 20 45
15	9 51 12.56 - 31.71	+ 5 04 54.1 + 762.1	26.30	27.52	0.319 798 + 4 121	10 16 12
16	9 50 40.85 22.21	5 17 36.2 733.2	25.96	27.17	.323 919 4 314	10 11 49
17	9 50 18.64 12.71	5 29 49.4 701.8	25.62	26.81	.328 233 4 500	10 07 34
18	9 50 05.93 - 3.25	5 41 31.2 668.2	25.28	26.45	.332 733 4 676	10 03 30
19	9 50 02.68 + 6.09	5 52 39.4 632.5	24.93	26.08	.337 409 4 846	9 59 35
20	9 50 08.77 + 15.35	+ 6 03 11.9 + 595.2	24.57	25.71	0.342 255 + 5 006	9 55 49
21	9 50 24.12 24.44	6 13 07.1 556.5	24.22	25.34	.347 261 5 160	9 52 12
22	9 50 48.56 33.35	6 22 23.6 516.5	23.86	24.97	.352 421 5 305	9 48 44
23	9 51 21.91 42.07	6 31 00.1 475.5	23.51	24.60	.357 726 5 442	9 45 25
24	9 52 03.98 50.57	6 38 55.6 433.7	23.16	24.23	.363 168 5 574	9 42 14
25	9 52 54.55 + 58.84	+ 6 46 09.3 + 391.3	22.81	23.86	0.368 742 + 5 696	9 39 12
26	9 53 53.39 66.88	6 52 40.6 348.4	22.46	23.50	.374 438 5 814	9 36 18
27	9 55 00.27 74.65	6 58 29.0 305.2	22.12	23.14	.380 252 5 925	9 33 32
28	9 56 14.92 82.19	7 03 34.2 261.8	21.78	22.79	.386 177 6 028	9 30 53
29	9 57 37.11 89.45	7 07 56.0 218.4	21.44	22.44	.392 205 6 128	9 28 22
30	9 59 06.56 + 96.46	+ 7 11 34.4 + 174.7	21.11	22.09	0.398 333 + 6 220	9 25 58
Oct. 1	10 00 43.02	+ 7 14 29.1	20.79	21.75	0.404 553	9 23 41

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	10 00 43.02	+ 7 14 29.1	20.79	21.75	0.404 553	9 23 41
2	10 02 26.21	7 16 40.7	20.47	21.42	.410 861	9 21 30
3	10 04 15.89	7 18 09.0	20.16	21.09	.417 252	9 19 26
4	10 06 11.79	7 18 54.6	19.85	20.77	.423 722	9 17 28
5	10 08 13.67	7 18 57.6	19.55	20.45	.430 265	9 15 35
6	10 10 21.29	+ 7 18 18.5	19.25	20.14	0.436 879	9 13 49
7	10 12 34.41	7 16 57.6	18.96	19.84	.443 559	9 12 07
8	10 14 52.81	7 14 55.3	18.68	19.54	.450 302	9 10 31
9	10 17 16.27	7 12 12.3	18.40	19.25	.457 106	9 09 00
10	10 19 44.58	7 08 48.8	18.13	18.97	.463 966	9 07 34
11	10 22 17.55	+ 7 04 45.2	17.86	18.69	0.470 880	9 06 12
12	10 24 54.98	7 00 02.2	17.60	18.42	.477 845	9 04 55
13	10 27 36.68	6 54 40.2	17.35	18.15	.484 858	9 03 41
14	10 30 22.48	6 48 39.6	17.10	17.89	.491 917	9 02 32
15	10 33 12.20	6 42 01.0	16.85	17.63	.499 018	9 01 27
16	10 36 05.70	+ 6 34 44.9	16.62	17.39	0.506 159	9 00 25
17	10 39 02.79	6 26 51.9	16.38	17.14	.513 337	8 59 27
18	10 42 03.34	6 18 22.4	16.16	16.91	.520 551	8 58 32
19	10 45 07.19	6 09 17.1	15.93	16.67	.527 797	8 57 41
20	10 48 14.20	5 59 36.7	15.72	16.45	.535 074	8 56 53
21	10 51 24.25	+ 5 49 21.7	15.51	16.22	0.542 378	8 56 07
22	10 54 37.19	5 38 32.9	15.30	16.01	.549 709	8 55 25
23	10 57 52.90	5 27 10.9	15.10	15.80	.557 063	8 54 45
24	11 01 11.25	5 15 16.3	14.90	15.59	.564 440	8 54 07
25	11 04 32.15	5 02 50.0	14.71	15.39	.571 836	8 53 33
26	11 07 55.46	+ 4 49 52.6	14.52	15.19	0.579 250	8 53 00
27	11 11 21.09	4 36 24.8	14.33	15.00	.586 680	8 52 30
28	11 14 48.93	4 22 27.5	14.16	14.81	.594 125	8 52 02
29	11 18 18.89	4 08 01.4	13.98	14.63	.601 582	8 51 37
30	11 21 50.88	3 53 07.3	13.81	14.45	.609 051	8 51 13
31	11 25 24.79	+ 3 37 46.0	13.64	14.27	0.616 530	8 50 51
Nov. 1	11 29 00.57	3 21 58.3	13.48	14.10	.624 017	8 50 31
2	11 32 38.12	3 05 45.1	13.32	13.93	.631 512	8 50 12
3	11 36 17.38	2 49 07.0	13.16	13.77	.639 014	8 49 56
4	11 39 58.28	2 32 04.9	13.01	13.61	.646 521	8 49 41
5	11 43 40.76	+ 2 14 39.7	12.86	13.45	0.654 034	8 49 27
6	11 47 24.76	1 56 52.1	12.71	13.30	.661 551	8 49 15
7	11 51 10.24	1 38 43.0	12.57	13.15	.669 072	8 49 04
8	11 54 57.14	1 20 12.9	12.43	13.01	.676 595	8 48 55
9	11 58 45.43	1 01 22.9	12.29	12.86	.684 122	8 48 48
10	12 02 35.07	+ 0 42 13.5	12.16	12.72	0.691 650	8 48 41
11	12 06 26.03	0 22 45.6	12.03	12.59	.699 179	8 48 36
12	12 10 18.28	+ 0 02 59.8	11.90	12.45	.706 708	8 48 32
13	12 14 11.80	- 0 17 03.1	11.77	12.32	.714 237	8 48 30
14	12 18 06.57	0 37 22.2	11.65	12.19	.721 765	8 48 28
15	12 22 02.55	- 0 57 56.9	11.53	12.07	0.729 290	8 48 28
16	12 25 59.75	- 1 18 46.3	11.41	11.94	0.736 812	8 48 29

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	12 25 59.75 ^s	- 1 18 46.3	11.41	11.94	0.736 812	8 48 29
17	12 29 58.13 ^s	1 39 49.7	11.30	11.82	.744 330 + 7 518	8 48 31
18	12 33 57.69	2 01 06.3	11.19	11.70	.751 844 7 514	8 48 35
19	12 37 58.41	2 22 35.3	11.08	11.59	.759 352 7 508	8 48 40
20	12 42 00.28	2 44 15.9	10.97	11.48	.766 853 7 501	8 48 45
	243.00	1311.3			7 494	
21	12 46 03.28	- 3 06 07.2	10.86	11.36	0.774 347	8 48 52
22	12 50 07.42 ^s	3 28 08.5	10.76	11.26	.781 833 + 7 486	8 49 00
23	12 54 12.68	3 50 18.9	10.65	11.15	.789 310 7 477	8 49 09
24	12 58 19.05	4 12 37.6	10.56	11.04	.796 777 7 467	8 49 19
25	13 02 26.54	4 35 03.7	10.46	10.94	.804 233 7 456	8 49 31
	248.59	1352.6			7 444	
26	13 06 35.13	- 4 57 36.3	10.36	10.84	0.811 677	8 49 43
27	13 10 44.81 ^s	5 20 14.7	10.27	10.74	.819 109 + 7 432	8 49 57
28	13 14 55.60	5 42 57.9	10.18	10.65	.826 528 7 419	8 50 11
29	13 19 07.49	6 05 45.0	10.08	10.55	.833 933 7 405	8 50 27
30	13 23 20.47	6 28 35.2	10.00	10.46	.841 323 7 390	8 50 44
	254.09	1372.4			7 376	
Dec. 1	13 27 34.56	- 6 51 27.6	9.91	10.37	0.848 699	8 51 02
2	13 31 49.74 ^s	7 14 21.5	9.82	10.28	.856 060 + 7 361	8 51 21
3	13 36 06.02	7 37 15.7	9.74	10.19	.863 406 7 346	8 51 41
4	13 40 23.41	8 00 09.7	9.66	10.11	.870 736 7 330	8 52 02
5	13 44 41.90	8 23 02.4	9.58	10.02	.878 051 7 315	8 52 25
	259.60	1370.6			7 299	
6	13 49 01.50	- 8 45 53.0	9.50	9.94	0.885 350	8 52 48
7	13 53 22.23 ^s	9 08 40.7	9.42	9.86	.892 633 + 7 283	8 53 13
8	13 57 44.10	9 31 24.7	9.35	9.78	.899 901 7 268	8 53 38
9	14 02 07.11	9 54 04.2	9.27	9.70	.907 152 7 251	8 54 05
10	14 06 31.29	10 16 38.2	9.20	9.62	.914 388 7 236	8 54 33
	265.36	1347.9			7 218	
11	14 10 56.65	-10 39 06.1	9.13	9.55	0.921 606	8 55 03
12	14 15 23.19 ^s	11 01 27.1	9.05	9.47	.928 808 + 7 202	8 55 33
13	14 19 50.94	11 23 40.2	8.99	9.40	.935 992 7 184	8 56 05
14	14 24 19.91	11 45 44.7	8.92	9.33	.943 158 7 166	8 56 38
15	14 28 50.11	12 07 39.7	8.85	9.26	.950 307 7 149	8 57 12
	271.44	1304.8			7 130	
16	14 33 21.55	-12 29 24.5	8.78	9.19	0.957 437	8 57 47
17	14 37 54.25 ^s	12 50 58.1	8.72	9.12	.964 549 + 7 112	8 58 24
18	14 42 28.20	13 12 19.8	8.66	9.06	.971 641 7 092	8 59 02
19	14 47 03.43	13 33 28.7	8.59	8.99	.978 713 7 072	8 59 41
20	14 51 39.94	13 54 24.0	8.53	8.93	.985 765 7 052	9 00 21
	277.80	1240.8			7 031	
21	14 56 17.74	-14 15 04.8	8.47	8.86	0.992 796	9 01 03
22	15 00 56.83 ^s	14 35 30.3	8.41	8.80	.999 806 + 7 010	9 01 46
23	15 05 37.21	14 55 39.6	8.35	8.74	1.006 793 6 987	9 02 30
24	15 10 18.89	15 15 31.9	8.30	8.68	.013 758 6 965	9 03 16
25	15 15 01.88	15 35 06.3	8.24	8.62	.020 700 6 942	9 04 03
	284.29	1155.7			6 918	
26	15 19 46.17	-15 54 22.0	8.18	8.56	1.027 618	9 04 51
27	15 24 31.77 ^s	16 13 18.2	8.13	8.51	.034 512 + 6 894	9 05 41
28	15 29 18.66	16 31 54.0	8.08	8.45	.041 381 6 869	9 06 32
29	15 34 06.83	16 50 08.6	8.02	8.40	.048 225 6 844	9 07 24
30	15 38 56.29	17 08 01.2	7.97	8.34	.055 045 6 820	9 08 17
	290.73	1049.7			6 794	
31	15 43 47.02	-17 25 30.9	7.92	8.29	1.061 839	9 09 12
32	15 48 38.99 ^s	-17 42 37.1	7.87	8.24	1.068 607 + 6 768	9 10 08

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Jan.	0	12 53 25.08	^s	- 3 30 00.3	- 623.2	3.27	6.16	1.429 398				6 16 58
	1	12 55 09.90	+104.82	3 40 23.5	617.4	3.30	6.20	.419 397	-10 001			6 14 46
	2	12 56 54.08	104.18	3 50 40.9	611.7	3.32	6.24	.409 380	10 017			6 12 33
	3	12 58 37.59	103.51	4 00 52.6	605.7	3.34	6.29	.399 349	10 031			6 10 20
	4	13 00 20.43	102.84	4 10 58.3	599.8	3.37	6.33	.389 304	10 045			6 08 07
			102.14						10 059			
	5	13 02 02.57		- 4 20 58.1	- 593.6	3.39	6.38	1.379 245				6 05 52
	6	13 03 43.99	+101.42	4 30 51.7	587.3	3.42	6.43	.369 174	-10 071			6 03 37
	7	13 05 24.69	100.70	4 40 39.0	581.0	3.44	6.47	.359 093	10 081			6 01 21
	8	13 07 04.63	99.94	4 50 20.0	574.4	3.47	6.52	.349 003	10 090			5 59 05
	9	13 08 43.80	99.17	4 59 54.4	567.7	3.50	6.57	.338 904	10 099			5 56 48
			98.38						10 105			
	10	13 10 22.18		- 5 09 22.1	- 561.1	3.52	6.62	1.328 799				5 54 29
	11	13 11 59.74	+ 97.56	5 18 43.2	554.1	3.55	6.67	.318 689	-10 110			5 52 10
	12	13 13 36.47	96.73	5 27 57.3	547.2	3.58	6.72	.308 576	10 113			5 49 51
	13	13 15 12.35	95.88	5 37 04.5	540.1	3.60	6.78	.298 460	10 116			5 47 30
	14	13 16 47.36	95.01	5 46 04.6	533.0	3.63	6.83	.288 344	10 116			5 45 08
			94.11						10 115			
	15	13 18 21.47		- 5 54 57.6	- 525.7	3.66	6.88	1.278 229				5 42 46
	16	13 19 54.68	+ 93.21	6 03 43.3	518.3	3.69	6.94	.268 117	-10 112			5 40 23
	17	13 21 26.96	92.28	6 12 21.6	511.0	3.72	7.00	.258 008	10 109			5 37 58
	18	13 22 58.30	91.34	6 20 52.6	503.5	3.75	7.05	.247 904	10 104			5 35 33
	19	13 24 28.67	90.37	6 29 16.1	495.8	3.78	7.11	.237 806	10 098			5 33 07
			89.38						10 089			
	20	13 25 58.05		- 6 37 31.9	- 488.3	3.81	7.17	1.227 717				5 30 40
	21	13 27 26.42	+ 88.37	6 45 40.2	480.5	3.84	7.23	.217 636	-10 081			5 28 12
	22	13 28 53.77	87.35	6 53 40.7	472.7	3.88	7.29	.207 566	10 070			5 25 42
	23	13 30 20.06	86.29	7 01 33.4	464.8	3.91	7.35	.197 507	10 059			5 23 12
	24	13 31 45.28	85.22	7 09 18.2	456.8	3.94	7.41	.187 461	10 046			5 20 41
			84.11						10 032			
	25	13 33 09.39		- 7 16 55.0	- 448.7	3.97	7.47	1.177 429				5 18 08
	26	13 34 32.38	+ 82.99	7 24 23.7	440.6	4.01	7.54	.167 412	-10 017			5 15 35
	27	13 35 54.20	81.82	7 31 44.3	432.2	4.04	7.60	.157 411	10 001			5 13 00
	28	13 37 14.83	80.63	7 38 56.5	423.7	4.08	7.67	.147 427	9 984			5 10 24
	29	13 38 34.25	79.42	7 46 00.2	415.1	4.11	7.74	.137 461	9 966			5 07 47
			78.16						9 946			
	30	13 39 52.41		- 7 52 55.3	- 406.4	4.15	7.80	1.127 515				5 05 09
	31	13 41 09.28	+ 76.87	7 59 41.7	397.6	4.19	7.87	.117 589	- 9 926			5 02 29
Feb.	1	13 42 24.82	75.54	8 06 19.3	388.6	4.23	7.94	.107 686	9 903			4 59 48
	2	13 43 39.01	74.19	8 12 47.9	379.4	4.26	8.02	.097 807	9 879			4 57 06
	3	13 44 51.81	72.80	8 19 07.3	370.2	4.30	8.09	.087 954	9 853			4 54 22
			71.35						9 826			
	4	13 46 03.16		- 8 25 17.5	- 360.8	4.34	8.16	1.078 128				4 51 37
	5	13 47 13.05	+ 69.89	8 31 18.3	351.3	4.38	8.24	.068 332	- 9 796			4 48 50
	6	13 48 21.41	68.36	8 37 09.6	341.6	4.42	8.31	.058 568	9 764			4 46 02
	7	13 49 28.22	66.81	8 42 51.2	331.8	4.46	8.39	.048 837	9 731			4 43 12
	8	13 50 33.43	65.21	8 48 23.0	321.8	4.50	8.47	.039 143	9 694			4 40 21
			63.57						9 657			
	9	13 51 37.00		- 8 53 44.8	- 311.9	4.55	8.55	1.029 486				4 37 28
	10	13 52 38.90	+ 61.90	8 58 56.7	301.6	4.59	8.63	.019 869	- 9 617			4 34 33
	11	13 53 39.08	60.18	9 03 58.3	291.4	4.63	8.71	.010 296	9 573			4 31 37
	12	13 54 37.51	58.43	9 08 49.7	281.1	4.68	8.79	1.000 767	9 529			4 28 39
	13	13 55 34.15	56.64	9 13 30.8	270.6	4.72	8.88	0.991 286	9 481			4 25 39
			54.82						9 433			
	14	13 56 28.97		- 9 18 01.4	- 260.0	4.77	8.96	0.981 853				4 22 37
	15	13 57 21.91	+ 52.94	9 22 21.4		4.81	9.05	0.972 472	- 9 381			4 19 34

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	13 57 21.91 + 51.04	- 9 22 21.4 - 249.4	4.81	9.05	0.972 472 - 9 327	4 19 34
16	13 58 12.95 + 49.09	9 26 30.8 - 238.8	4.86	9.14	.963 145 - 9 272	4 16 28
17	13 59 02.04 + 47.10	9 30 29.6 - 227.9	4.91	9.23	.953 873 - 9 213	4 13 21
18	13 59 49.14 + 45.08	9 34 17.5 - 216.9	4.95	9.32	.944 660 - 9 153	4 10 12
19	14 00 34.22 + 43.01	9 37 54.4 - 206.1	5.00	9.41	.935 507 - 9 091	4 07 00
20	14 01 17.23 + 40.90	- 9 41 20.5 - 194.8	5.05	9.50	0.926 416 - 9 026	4 03 47
21	14 01 58.13 + 38.75	9 44 35.3 - 183.7	5.10	9.59	.917 390 - 8 960	4 00 31
22	14 02 36.88 + 36.55	9 47 39.0 - 172.4	5.15	9.69	.908 430 - 8 891	3 57 13
23	14 03 13.43 + 34.30	9 50 31.4 - 160.8	5.20	9.78	.899 539 - 8 820	3 53 54
24	14 03 47.73 + 32.02	9 53 12.2 - 149.3	5.25	9.88	.890 719 - 8 747	3 50 31
25	14 04 19.75 + 29.68	- 9 55 41.5 - 137.6	5.31	9.98	0.881 972 - 8 673	3 47 07
26	14 04 49.43 + 27.29	9 57 59.1 - 125.7	5.36	10.08	.873 299 - 8 595	3 43 40
27	14 05 16.72 + 24.85	10 00 04.8 - 113.6	5.41	10.18	.864 704 - 8 515	3 40 11
28	14 05 41.57 + 22.38	10 01 58.4 - 101.4	5.47	10.28	.856 189 - 8 433	3 36 40
Mar. 1	14 06 03.95 + 19.84	10 03 39.8 - 89.1	5.52	10.38	.847 756 - 8 347	3 33 06
2	14 06 23.79 + 17.26	- 10 05 08.9 - 76.6	5.58	10.48	0.839 409 - 8 259	3 29 29
3	14 06 41.05 + 14.62	10 06 25.5 - 63.9	5.63	10.59	.831 150 - 8 168	3 25 50
4	14 06 55.67 + 11.94	10 07 29.4 - 51.1	5.69	10.69	.822 982 - 8 073	3 22 08
5	14 07 07.61 + 9.21	10 08 20.5 - 38.2	5.74	10.80	.814 909 - 7 976	3 18 24
6	14 07 16.82 + 6.45	10 08 58.7 - 25.2	5.80	10.91	.806 933 - 7 874	3 14 37
7	14 07 23.27 + 3.63	- 10 09 23.9 - 12.0	5.86	11.01	0.799 059 - 7 769	3 10 47
8	14 07 26.90 + 0.80	10 09 35.9 + 1.3	5.91	11.12	.791 290 - 7 661	3 06 54
9	14 07 27.70 - 2.08	10 09 34.6 - 14.6	5.97	11.23	.783 629 - 7 550	3 02 59
10	14 07 25.62 - 4.99	10 09 20.0 - 28.0	6.03	11.34	.776 079 - 7 434	2 59 00
11	14 07 20.63 - 7.92	10 08 52.0 - 41.4	6.09	11.45	.768 645 - 7 316	2 54 59
12	14 07 12.71 - 10.87	- 10 08 10.6 + 54.8	6.15	11.56	0.761 329 - 7 193	2 50 55
13	14 07 01.84 - 13.83	10 07 15.8 + 68.4	6.21	11.67	.754 136 - 7 068	2 46 48
14	14 06 48.01 - 16.82	10 06 07.4 - 81.7	6.26	11.78	.747 068 - 6 939	2 42 38
15	14 06 31.19 - 19.81	10 04 45.7 - 95.2	6.32	11.89	.740 129 - 6 807	2 38 25
16	14 06 11.38 - 22.81	10 03 10.5 - 108.7	6.38	12.00	.733 322 - 6 671	2 34 09
17	14 05 48.57 - 25.80	- 10 01 21.8 + 121.9	6.44	12.11	0.726 651 - 6 532	2 29 50
18	14 05 22.77 - 28.80	9 59 19.9 + 135.2	6.50	12.22	.720 119 - 6 390	2 25 28
19	14 04 53.97 - 31.79	9 57 04.7 + 148.5	6.56	12.33	.713 729 - 6 244	2 21 03
20	14 04 22.18 - 34.76	9 54 36.2 + 161.5	6.61	12.44	.707 485 - 6 095	2 16 35
21	14 03 47.42 - 37.72	9 51 54.7 + 174.4	6.67	12.55	.701 390 - 5 943	2 12 05
22	14 03 09.70 - 40.66	- 9 49 00.3 + 187.3	6.73	12.65	0.695 447 - 5 789	2 07 31
23	14 02 29.04 - 43.58	9 45 53.0 + 200.1	6.79	12.76	.689 658 - 5 632	2 02 54
24	14 01 45.46 - 46.46	9 42 32.9 + 212.6	6.84	12.87	.684 026 - 5 471	1 58 15
25	14 00 59.00 - 49.32	9 39 00.3 + 225.1	6.90	12.97	.678 555 - 5 308	1 53 33
26	14 00 09.68 - 52.13	9 35 15.2 + 237.4	6.95	13.07	.673 247 - 5 141	1 48 48
27	13 59 17.55 - 54.89	- 9 31 17.8 + 249.3	7.00	13.17	0.668 106 - 4 973	1 44 00
28	13 58 22.66 - 57.60	9 27 08.5 + 261.2	7.06	13.27	.663 133 - 4 800	1 39 09
29	13 57 25.06 - 60.27	9 22 47.3 + 272.7	7.11	13.37	.658 333 - 4 624	1 34 16
30	13 56 24.79 - 62.86	9 18 14.6 + 283.9	7.16	13.46	.653 709 - 4 446	1 29 20
31	13 55 21.93 - 65.38	9 13 30.7 + 294.9	7.21	13.55	.649 263 - 4 265	1 24 21
Apr. 1	13 54 16.55 - 67.83	- 9 08 35.8 + 305.3	7.26	13.64	0.644 998 - 4 079	1 19 20
2	13 53 08.72 - 69.83	- 9 03 30.5 + 316.8	7.30	13.73	0.640 919 - 3 896	1 14 17

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	13 54 16.55 - 67.83	- 9 08 35.8 + 305.3	7.26	13.64	0.644 998 - 4 079	1 19 20
2	13 53 08.72 - 70.16	9 03 30.5 + 324.9	7.30	13.73	.640 919 - 3 892	1 14 17
3	13 51 58.56 - 72.41	8 58 15.1 + 333.9	7.35	13.81	.637 027 - 3 701	1 09 11
4	13 50 46.15 - 74.55	8 52 50.2 + 342.5	7.39	13.89	.633 326 - 3 508	1 04 03
5	13 49 31.60 - 76.56	8 47 16.3 + 350.2	7.43	13.97	.629 818 - 3 312	0 58 53
6	13 48 15.04 - 78.44	- 8 41 33.8 + 357.3	7.47	14.05	0.626 506 - 3 114	0 53 41
7	13 46 56.60 - 80.19	8 35 43.6 + 363.7	7.51	14.12	.623 392 - 2 914	0 48 27
8	13 45 36.41 - 81.79	8 29 46.3 + 369.3	7.54	14.18	.620 478 - 2 712	0 43 11
9	13 44 14.62 - 83.24	8 23 42.6 + 374.1	7.58	14.24	.617 766 - 2 508	0 37 54
10	13 42 51.38 - 84.54	8 17 33.3 + 378.1	7.61	14.30	.615 258 - 2 304	0 32 35
11	13 41 26.84 - 85.66	- 8 11 19.2 + 381.3	7.64	14.36	0.612 954 - 2 098	0 27 16
12	13 40 01.18 - 86.64	8 05 01.1 + 383.4	7.66	14.41	.610 856 - 1 891	0 21 54
13	13 38 34.54 - 87.42	7 58 39.8 + 384.9	7.69	14.45	.608 965 - 1 685	0 16 32
14	13 37 07.12 - 88.05	7 52 16.4 + 385.3	7.71	14.49	.607 280 - 1 477	0 11 10
15	13 35 39.07 - 88.50	7 45 51.5 + 384.8	7.73	14.53	.605 803 - 1 270	0 05 46
16	13 34 10.57 - 88.77	- 7 39 26.2 + 383.4	7.74	14.56	0.604 533 - 1 063	{ 0 00 22 } { 23 54 58 }
17	13 32 41.80 - 88.86	7 33 01.4 + 381.2	7.76	14.58	.603 470 - 858	23 49 34
18	13 31 12.94 - 88.80	7 26 38.0 + 378.1	7.77	14.60	.602 612 - 653	23 44 10
19	13 29 44.14 - 88.55	7 20 16.8 + 374.1	7.77	14.62	.601 959 - 450	23 38 46
20	13 28 15.59 - 88.14	7 13 58.7 + 369.2	7.78	14.63	.601 509 - 247	23 33 23
21	13 26 47.45 - 87.57	- 7 07 44.6 + 363.6	7.78	14.64	0.601 262 - 47	23 28 00
22	13 25 19.88 - 86.83	7 01 35.4 + 357.2	7.78	14.64	.601 215 - 152	23 22 38
23	13 23 53.05 - 85.93	6 55 31.8 + 349.8	7.78	14.63	.601 367 - 348	23 17 16
24	13 22 27.12 - 84.89	6 49 34.6 + 341.9	7.78	14.62	.601 715 - 543	23 11 56
25	13 21 02.23 - 83.70	6 43 44.8 + 333.1	7.77	14.61	.602 258 - 735	23 06 37
26	13 19 38.53 - 82.37	- 6 38 02.9 + 323.7	7.76	14.59	0.602 993 - 926	23 01 19
27	13 18 16.16 - 80.89	6 32 29.8 + 313.6	7.75	14.57	.603 919 - 1 114	22 56 03
28	13 16 55.27 - 79.28	6 27 06.1 + 302.7	7.74	14.54	.605 033 - 1 300	22 50 48
29	13 15 35.99 - 77.54	6 21 52.5 + 291.2	7.72	14.51	.606 333 - 1 484	22 45 35
30	13 14 18.45 - 75.68	6 16 49.8 + 279.0	7.70	14.48	.607 817 - 1 665	22 40 24
May 1	13 13 02.77 - 73.68	- 6 11 58.6 + 266.1	7.68	14.44	0.609 482 - 1 843	22 35 14
2	13 11 49.09 - 71.56	6 07 19.6 + 252.8	7.66	14.39	.611 325 - 2 018	22 30 07
3	13 10 37.53 - 69.34	6 02 53.5 + 238.8	7.63	14.35	.613 343 - 2 190	22 25 02
4	13 09 28.19 - 67.01	5 58 40.7 + 224.4	7.60	14.30	.615 533 - 2 358	22 20 00
5	13 08 21.18 - 64.56	5 54 41.9 + 209.3	7.57	14.24	.617 891 - 2 524	22 14 59
6	13 07 16.62 - 62.05	- 5 50 57.5 + 193.8	7.54	14.18	0.620 415 - 2 685	22 10 02
7	13 06 14.57 - 59.42	5 47 28.2 + 178.0	7.51	14.12	.623 100 - 2 843	22 05 06
8	13 05 15.15 - 56.74	5 44 14.4 + 161.7	7.48	14.06	.625 943 - 2 997	22 00 14
9	13 04 18.41 - 53.97	5 41 16.4 + 145.1	7.44	13.99	.628 940 - 3 147	21 55 24
10	13 03 24.44 - 51.14	5 38 34.7 + 128.3	7.40	13.92	.632 087 - 3 292	21 50 37
11	13 02 33.30 - 48.26	- 5 36 09.6 + 111.3	7.37	13.85	0.635 379 - 3 435	21 45 53
12	13 01 45.04 - 45.34	5 34 01.3 + 93.9	7.33	13.78	.638 814 - 3 571	21 41 12
13	13 00 59.70 - 42.37	5 32 10.0 + 76.6	7.29	13.70	.642 385 - 3 705	21 36 33
14	13 00 17.33 - 39.36	5 30 36.1 + 59.0	7.24	13.62	.646 090 - 3 833	21 31 58
15	12 59 37.97 - 36.35	5 29 19.5 + 41.6	7.20	13.54	.649 923 - 3 957	21 27 26
16	12 59 01.62 - 33.32	- 5 28 20.5 + 27.9	7.16	13.46	0.653 880 - 4 078	21 22 56
17	12 58 28.30 - 30.29	- 5 27 38.9 + 14.2	7.11	13.37	0.657 958 - 4 200	21 18 30

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	12 58 28.30	— 5 27 38.9	7.11	13.37	0.657 958	21 18 30
18	12 57 58.04	5 27 14.9	7.07	13.29	.662 151	21 14 07
19	12 57 30.82	5 27 08.5	7.02	13.20	.666 456	21 09 46
20	12 57 06.65	5 27 19.4	6.98	13.12	.670 868	21 05 29
21	12 56 45.51	5 27 47.6	6.93	13.03	.675 384	21 01 15
22	12 56 27.41	— 5 28 33.1	6.88	12.94	0.679 999	20 57 04
23	12 56 12.32	5 29 35.6	6.84	12.85	.684 710	20 52 55
24	12 56 00.21	5 30 55.0	6.79	12.76	.689 514	20 48 50
25	12 55 51.08	5 32 31.1	6.74	12.67	.694 407	20 44 47
26	12 55 44.90	5 34 23.8	6.69	12.58	.699 387	20 40 48
27	12 55 41.63	— 5 36 32.7	6.64	12.49	0.704 450	20 36 51
28	12 55 41.26	5 38 57.9	6.60	12.40	.709 592	20 32 57
29	12 55 43.75	5 41 38.9	6.55	12.31	.714 813	20 29 06
30	12 55 49.10	5 44 35.8	6.50	12.22	.720 107	20 25 18
31	12 55 57.26	5 47 48.3	6.45	12.13	.725 474	20 21 33
June 1	12 56 08.22	— 5 51 16.1	6.40	12.04	0.730 908	20 17 50
2	12 56 21.94	5 54 59.2	6.36	11.95	.736 409	20 14 10
3	12 56 38.40	5 58 57.3	6.31	11.86	.741 972	20 10 33
4	12 56 57.57	6 03 10.2	6.26	11.77	.747 595	20 06 58
5	12 57 19.41	6 07 37.8	6.21	11.68	.753 275	20 03 26
6	12 57 43.89	— 6 12 19.7	6.17	11.59	0.759 010	19 59 57
7	12 58 10.99	6 17 15.8	6.12	11.51	.764 796	19 56 30
8	12 58 40.65	6 22 25.8	6.07	11.42	.770 631	19 53 06
9	12 59 12.86	6 27 49.5	6.03	11.33	.776 513	19 49 44
10	12 59 47.57	6 33 26.6	5.98	11.25	.782 438	19 46 25
11	13 00 24.74	— 6 39 16.9	5.94	11.16	0.788 403	19 43 08
12	13 01 04.33	6 45 20.1	5.89	11.08	.794 407	19 39 53
13	13 01 46.31	6 51 35.8	5.85	10.99	.800 446	19 36 41
14	13 02 30.62	6 58 03.9	5.80	10.91	.806 518	19 33 31
15	13 03 17.23	7 04 44.0	5.76	10.83	.812 621	19 30 23
16	13 04 06.09	— 7 11 35.8	5.72	10.75	0.818 753	19 27 18
17	13 04 57.17	7 18 38.9	5.67	10.67	.824 911	19 24 14
18	13 05 50.42	7 25 53.1	5.63	10.59	.831 093	19 21 13
19	13 06 45.81	7 33 18.1	5.59	10.51	.837 298	19 18 14
20	13 07 43.28	7 40 53.6	5.55	10.43	.843 523	19 15 17
21	13 08 42.81	— 7 48 39.2	5.51	10.36	0.849 769	19 12 22
22	13 09 44.34	7 56 34.6	5.47	10.28	.856 032	19 09 29
23	13 10 47.85	8 04 39.7	5.43	10.21	.862 313	19 06 38
24	13 11 53.29	8 12 54.0	5.39	10.13	.868 609	19 03 48
25	13 13 00.63	8 21 17.3	5.35	10.06	.874 920	19 01 01
26	13 14 09.85	— 8 29 49.4	5.31	9.99	0.881 245	18 58 15
27	13 15 20.92	8 38 30.1	5.27	9.91	.887 582	18 55 32
28	13 16 33.81	8 47 19.0	5.24	9.84	.893 931	18 52 50
29	13 17 48.48	8 56 16.1	5.20	9.77	.900 290	18 50 09
30	13 19 04.93	9 05 21.0	5.16	9.71	.906 659	18 47 31
July 1	13 20 23.13	— 9 14 33.5	5.13	9.64	0.913 035	18 44 54
2	13 21 43.05	— 9 23 53.5	5.09	9.57	0.919 419	18 42 19

MARS, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
July 1	13 20 23.13 + 79.92	- 9 14 33.5 - 560.0	5.13	9.64	0.913 035 + 6 384	18 44 54
2	13 21 43.05 81.62	9 23 53.5 567.3	5.09	9.57	.919 419 6 389	18 42 19
3	13 23 04.67 83.30	9 33 20.8 574.2	5.06	9.51	.925 808 6 394	18 39 46
4	13 24 27.97 84.96	9 42 55.0 581.1	5.02	9.44	.932 202 6 398	18 37 14
5	13 25 52.93 86.59	9 52 36.1 587.6	4.99	9.38	.938 600 6 401	18 34 44
6	13 27 19.52 + 88.20	-10 02 23.7 - 594.0	4.95	9.31	0.945 001 + 6 401	18 32 16
7	13 28 47.72 89.79	10 12 17.7 600.2	4.92	9.25	.951 402 6 401	18 29 49
8	13 30 17.51 91.36	10 22 17.9 606.0	4.89	9.19	.957 803 6 401	18 27 23
9	13 31 48.87 92.90	10 32 23.9 611.8	4.85	9.13	.964 204 6 398	18 25 00
10	13 33 21.77 94.43	10 42 35.7 617.1	4.82	9.07	.970 602 6 395	18 22 37
11	13 34 56.20 + 95.92	-10 52 52.8 - 622.3	4.79	9.01	0.976 997 + 6 390	18 20 17
12	13 36 32.12 97.39	11 03 15.1 627.2	4.76	8.95	.983 387 6 384	18 17 57
13	13 38 09.51 98.86	11 13 42.3 631.9	4.73	8.89	.989 771 6 377	18 15 40
14	13 39 48.37 100.28	11 24 14.2 636.3	4.70	8.83	0.996 148 6 370	18 13 23
15	13 41 28.65 101.70	11 34 50.5 640.4	4.67	8.78	1.002 518 6 362	18 11 08
16	13 43 10.35 + 103.09	-11 45 30.9 - 644.4	4.64	8.72	1.008 880 + 6 353	18 08 55
17	13 44 53.44 104.45	11 56 15.3 648.0	4.61	8.67	.015 233 6 344	18 06 42
18	13 46 37.89 105.81	12 07 03.3 651.5	4.58	8.61	.021 577 6 334	18 04 31
19	13 48 23.70 107.13	12 17 54.8 654.6	4.55	8.56	.027 911 6 324	18 02 22
20	13 50 10.83 108.44	12 28 49.4 657.5	4.53	8.51	.034 235 6 314	18 00 14
21	13 51 59.27 + 109.74	-12 39 46.9 - 660.2	4.50	8.46	1.040 549 + 6 304	17 58 07
22	13 53 49.01 111.02	12 50 47.1 662.6	4.47	8.41	.046 853 6 294	17 56 01
23	13 55 40.03 112.28	13 01 49.7 665.0	4.44	8.36	.053 147 6 283	17 53 57
24	13 57 32.31 113.54	13 12 54.7 666.9	4.42	8.31	.059 430 6 272	17 51 53
25	13 59 25.85 114.78	13 24 01.6 668.8	4.39	8.26	.065 702 6 262	17 49 52
26	14 01 20.63 + 116.03	-13 35 10.4 - 670.4	4.37	8.21	1.071 964 + 6 250	17 47 51
27	14 03 16.66 117.26	13 46 20.8 671.9	4.34	8.16	.078 214 6 240	17 45 51
28	14 05 13.92 118.48	13 57 32.7 673.2	4.32	8.11	.084 454 6 228	17 43 53
29	14 07 12.40 119.69	14 08 45.9 674.3	4.29	8.07	.090 682 6 216	17 41 56
30	14 09 12.09 120.91	14 20 00.2 675.2	4.27	8.02	.096 898 6 203	17 40 00
31	14 11 13.00 + 122.12	-14 31 15.4 - 675.8	4.24	7.98	1.103 101 + 6 192	17 38 06
Aug. 1	14 13 15.12 123.31	14 42 31.2 676.4	4.22	7.93	.109 293 6 179	17 36 12
2	14 15 18.43 124.49	14 53 47.6 676.7	4.20	7.89	.115 472 6 165	17 34 20
3	14 17 22.92 125.69	15 05 04.3 676.8	4.17	7.85	.121 637 6 151	17 32 29
4	14 19 28.61 126.85	15 16 21.1 676.7	4.15	7.80	.127 788 6 138	17 30 39
5	14 21 35.46 + 128.02	-15 27 37.8 - 676.5	4.13	7.76	1.133 926 + 6 123	17 28 50
6	14 23 43.48 129.18	15 38 54.3 675.8	4.11	7.72	.140 049 6 107	17 27 03
7	14 25 52.66 130.33	15 50 10.1 675.2	4.08	7.68	.146 156 6 092	17 25 16
8	14 28 02.99 131.46	16 01 25.3 674.1	4.06	7.64	.152 248 6 075	17 23 31
9	14 30 14.45 132.60	16 12 39.4 672.9	4.04	7.60	.158 323 6 058	17 21 47
10	14 32 27.05 + 133.72	-16 23 52.3 - 671.4	4.02	7.56	1.164 381 + 6 041	17 20 04
11	14 34 40.77 134.84	16 35 03.7 669.8	4.00	7.52	.170 422 6 023	17 18 22
12	14 36 55.61 135.94	16 46 13.5 667.8	3.98	7.48	.176 445 6 006	17 16 41
13	14 39 11.55 137.04	16 57 21.3 665.7	3.96	7.44	.182 451 5 988	17 15 02
14	14 41 28.59 138.11	17 08 27.0 663.3	3.94	7.40	.188 439 5 970	17 13 23
15	14 43 46.70 + 139.19	-17 19 30.3 - 660.7	3.92	7.37	1.194 409 + 5 952	17 11 45
16	14 46 05.89	-17 30 31.0	3.90	7.33	1.200 361	17 10 09

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] [″]	[″]	[″]		^h ^m ^s
Aug. 16	14 46 05.89 ^s	-17 30 31.0	3.90	7.33	1.200 361	17 10 09
17	14 48 26.13 +140.24	17 41 28.8	3.88	7.30	.206 296 + 5 935	17 08 33
18	14 50 47.43 141.30	17 52 23.5	3.86	7.26	.212 213 5 917	17 06 59
19	14 53 09.77 142.34	18 03 14.8	3.84	7.22	.218 113 5 900	17 05 26
20	14 55 33.15 143.38	18 14 02.6	3.82	7.19	.223 997 5 884	17 03 53
	144.41	644.1			5 867	
21	14 57 57.56	-18 24 46.7	3.81	7.16	1.229 864	17 02 22
22	15 00 23.00 +145.44	18 35 26.7	3.79	7.12	.235 715 + 5 851	17 00 52
23	15 02 49.47 146.47	18 46 02.6	3.77	7.09	.241 550 5 835	16 59 22
24	15 05 16.96 147.49	18 56 34.1	3.75	7.05	.247 370 5 820	16 57 54
25	15 07 45.48 148.52	19 07 01.0	3.73	7.02	.253 174 5 804	16 56 27
	149.53	622.1			5 788	
26	15 10 15.01	-19 17 23.1	3.72	6.99	1.258 962	16 55 01
27	15 12 45.56 +150.55	19 27 40.3	3.70	6.96	.264 735 + 5 773	16 53 36
28	15 15 17.13 151.57	19 37 52.3	3.68	6.93	.270 493 5 758	16 52 11
29	15 17 49.71 152.58	19 47 58.9	3.67	6.90	.276 235 5 742	16 50 48
30	15 20 23.29 153.58	19 58 00.0	3.65	6.86	.281 963 5 728	16 49 26
	154.60	595.2			5 712	
31	15 22 57.89	-20 07 55.2	3.63	6.83	1.287 675	16 48 05
Sept. 1	15 25 33.48 +155.59	20 17 44.5	3.62	6.80	.293 372 + 5 697	16 46 45
2	15 28 10.07 156.59	20 27 27.6	3.60	6.77	.299 053 5 681	16 45 25
3	15 30 47.65 157.58	20 37 04.2	3.59	6.74	.304 719 5 666	16 44 07
4	15 33 26.21 158.56	20 46 34.1	3.57	6.72	.310 369 5 650	16 42 50
	159.55	563.2			5 633	
5	15 36 05.76	-20 55 57.3	3.56	6.69	1.316 002	16 41 34
6	15 38 46.28 +160.52	21 05 13.2	3.54	6.66	.321 620 + 5 618	16 40 18
7	15 41 27.77 161.49	21 14 21.9	3.53	6.63	.327 220 5 600	16 39 04
8	15 44 10.21 162.44	21 23 22.9	3.51	6.60	.332 803 5 583	16 37 51
9	15 46 53.61 163.40	21 32 16.2	3.50	6.58	.338 369 5 566	16 36 38
	164.34	525.2			5 549	
10	15 49 37.95	-21 41 01.4	3.48	6.55	1.343 918	16 35 27
11	15 52 23.22 +165.27	21 49 38.4	3.47	6.52	.349 451 + 5 533	16 34 16
12	15 55 09.40 166.18	21 58 06.9	3.45	6.49	.354 966 5 515	16 33 06
13	15 57 56.48 167.08	22 06 26.7	3.44	6.47	.360 466 5 500	16 31 58
14	16 00 44.45 167.97	22 14 37.6	3.43	6.44	.365 949 5 483	16 30 50
	168.86	481.7			5 467	
15	16 03 33.31	-22 22 39.3	3.41	6.42	1.371 416	16 29 43
16	16 06 23.03 +169.72	22 30 31.7	3.40	6.39	.376 869 + 5 453	16 28 36
17	16 09 13.61 170.58	22 38 14.4	3.39	6.37	.382 306 5 437	16 27 31
18	16 12 05.04 171.43	22 45 47.4	3.37	6.34	.387 730 5 424	16 26 27
19	16 14 57.32 172.28	22 53 10.3	3.36	6.32	.393 139 5 409	16 25 23
	173.12	432.8			5 396	
20	16 17 50.44	-23 00 23.1	3.35	6.29	1.398 535	16 24 20
21	16 20 44.38 +173.94	23 07 25.4	3.33	6.27	.403 919 + 5 384	16 23 18
22	16 23 39.15 174.77	23 14 17.2	3.32	6.24	.409 289 5 370	16 22 17
23	16 26 34.74 175.59	23 20 58.2	3.31	6.22	.414 648 5 359	16 21 17
24	16 29 31.13 176.39	23 27 28.3	3.30	6.20	.419 994 5 346	16 20 17
	177.19	378.9			5 335	
25	16 32 28.32	-23 33 47.2	3.28	6.17	1.425 329	16 19 18
26	16 35 26.30 +177.98	23 39 54.8	3.27	6.15	.430 652 + 5 323	16 18 20
27	16 38 25.07 178.77	23 45 51.0	3.26	6.13	.435 964 5 312	16 17 23
28	16 41 24.60 179.53	23 51 35.5	3.25	6.11	.441 265 5 301	16 16 27
29	16 44 24.89 180.29	23 57 08.2	3.24	6.08	.446 555 5 290	16 15 31
	181.04	320.6			5 278	
30	16 47 25.93	-24 02 28.8	3.22	6.06	1.451 833	16 14 36
Oct. 1	16 50 27.71 +181.78	24 07 37.2	3.21	6.04	.457 102 + 5 269	16 13 42

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Oct. 1	16 50 27.71 ^{+182.50}	-24 07 37.2 ^{-295.9}	3.21	6.04	1.457 102 ^{+5 256}	16 13 42
2	16 53 30.21 ^{183.22}	24 12 33.1 ^{283.4}	3.20	6.02	.462 358 ^{5 246}	16 12 48
3	16 56 33.43 ^{183.92}	24 17 16.5 ^{270.5}	3.19	6.00	.467 604 ^{5 234}	16 11 55
4	16 59 37.35 ^{184.61}	24 21 47.0 ^{257.6}	3.18	5.97	.472 838 ^{5 222}	16 11 03
5	17 02 41.96 ^{185.28}	24 26 04.6 ^{244.5}	3.17	5.95	.478 060 ^{5 211}	16 10 12
6	17 05 47.24 ^{+185.94}	-24 30 09.1 ^{-231.2}	3.16	5.93	1.483 271 ^{+5 199}	16 09 21
7	17 08 53.18 ^{186.58}	24 34 00.3 ^{217.7}	3.14	5.91	.488 470 ^{5 186}	16 08 31
8	17 11 59.76 ^{187.20}	24 37 38.0 ^{204.2}	3.13	5.89	.493 656 ^{5 175}	16 07 41
9	17 15 06.96 ^{187.79}	24 41 02.2 ^{190.3}	3.12	5.87	.498 831 ^{5 164}	16 06 52
10	17 18 14.75 ^{188.37}	24 44 12.5 ^{176.5}	3.11	5.85	.503 995 ^{5 153}	16 06 04
11	17 21 23.12 ^{+188.92}	-24 47 09.0 ^{-162.4}	3.10	5.83	1.509 148 ^{+5 142}	16 05 16
12	17 24 32.04 ^{189.45}	24 49 51.4 ^{148.2}	3.09	5.81	.514 290 ^{5 131}	16 04 29
13	17 27 41.49 ^{189.98}	24 52 19.6 ^{133.9}	3.08	5.79	.519 421 ^{5 122}	16 03 42
14	17 30 51.47 ^{190.47}	24 54 33.5 ^{119.3}	3.07	5.77	.524 543 ^{5 112}	16 02 56
15	17 34 01.94 ^{190.95}	24 56 32.8 ^{104.8}	3.06	5.75	.529 655 ^{5 104}	16 02 10
16	17 37 12.89 ^{+191.42}	-24 58 17.6 ^{-90.1}	3.05	5.73	1.534 759 ^{+5 095}	16 01 25
17	17 40 24.31 ^{191.88}	24 59 47.7 ^{75.2}	3.04	5.71	.539 854 ^{5 088}	16 00 40
18	17 43 36.19 ^{192.30}	25 01 02.9 ^{60.3}	3.03	5.70	.544 942 ^{5 080}	15 59 56
19	17 46 48.49 ^{192.73}	25 02 03.2 ^{45.3}	3.02	5.68	.550 022 ^{5 073}	15 59 12
20	17 50 01.22 ^{193.13}	25 02 48.5 ^{30.2}	3.01	5.66	.555 095 ^{5 067}	15 58 28
21	17 53 14.35 ^{+193.51}	-25 03 18.7 ^{-15.0}	3.00	5.64	1.560 162 ^{+5 061}	15 57 45
22	17 56 27.86 ^{193.89}	25 03 33.7 ^{0.2}	2.99	5.62	.565 223 ^{5 054}	15 57 02
23	17 59 41.75 ^{194.23}	25 03 33.5 ^{15.6}	2.98	5.60	.570 277 ^{5 050}	15 56 20
24	18 02 55.98 ^{194.57}	25 03 17.9 ^{31.0}	2.97	5.59	.575 327 ^{5 044}	15 55 38
25	18 06 10.55 ^{194.89}	25 02 46.9 ^{46.5}	2.96	5.57	.580 371 ^{5 039}	15 54 56
26	18 09 25.44 ^{+195.19}	-25 02 00.4 ^{+62.0}	2.95	5.55	1.585 410 ^{+5 034}	15 54 15
27	18 12 40.63 ^{195.48}	25 00 58.4 ^{77.6}	2.94	5.53	.590 444 ^{5 030}	15 53 34
28	18 15 56.11 ^{195.73}	24 59 40.8 ^{93.3}	2.93	5.52	.595 474 ^{5 025}	15 52 53
29	18 19 11.84 ^{195.99}	24 58 07.5 ^{109.0}	2.92	5.50	.600 499 ^{5 020}	15 52 12
30	18 22 27.83 ^{196.22}	24 56 18.5 ^{124.9}	2.91	5.48	.605 519 ^{5 015}	15 51 32
31	18 25 44.05 ^{+196.43}	-24 54 13.6 ^{+140.6}	2.91	5.46	1.610 534 ^{+5 011}	15 50 51
Nov. 1	18 29 00.48 ^{196.64}	24 51 53.0 ^{156.6}	2.90	5.45	.615 545 ^{5 005}	15 50 11
2	18 32 17.12 ^{196.81}	24 49 16.4 ^{172.5}	2.89	5.43	.620 550 ^{4 999}	15 49 32
3	18 35 33.93 ^{196.98}	24 46 23.9 ^{188.4}	2.88	5.41	.625 549 ^{4 994}	15 48 52
4	18 38 50.91 ^{197.11}	24 43 15.5 ^{204.3}	2.87	5.40	.630 543 ^{4 988}	15 48 13
5	18 42 08.02 ^{+197.22}	-24 39 51.2 ^{+220.2}	2.86	5.38	1.635 531 ^{+4 983}	15 47 33
6	18 45 25.24 ^{197.31}	24 36 11.0 ^{236.1}	2.85	5.36	.640 514 ^{4 977}	15 46 54
7	18 48 42.55 ^{197.37}	24 32 14.9 ^{252.0}	2.84	5.35	.645 491 ^{4 972}	15 46 15
8	18 51 59.92 ^{197.41}	24 28 02.9 ^{268.0}	2.84	5.33	.650 463 ^{4 967}	15 45 36
9	18 55 17.33 ^{197.43}	24 23 34.9 ^{283.7}	2.83	5.32	.655 430 ^{4 962}	15 44 57
10	18 58 34.76 ^{+197.44}	-24 18 51.2 ^{+299.7}	2.82	5.30	1.660 392 ^{+4 959}	15 44 17
11	19 01 52.20 ^{197.41}	24 13 51.5 ^{315.5}	2.81	5.28	.665 351 ^{4 954}	15 43 38
12	19 05 09.61 ^{197.38}	24 08 36.0 ^{331.2}	2.80	5.27	.670 305 ^{4 952}	15 42 59
13	19 08 26.99 ^{197.33}	24 03 04.8 ^{347.0}	2.79	5.25	.675 257 ^{4 948}	15 42 20
14	19 11 44.32 ^{197.26}	23 57 17.8 ^{362.7}	2.79	5.24	.680 205 ^{4 946}	15 41 41
15	19 15 01.58 ^{+197.17}	-23 51 15.1 ^{+378.3}	2.78	5.22	1.685 151 ^{+4 944}	15 41 01
16	19 18 18.75	-23 44 56.8	2.77	5.21	1.690 095	15 40 22

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	19 18 18.75 ^s	-23 44 56.8	2.77	5.21	1.690 095	15 40 22
17	19 21 35.83 ^{+197.08}	23 38 22.9 ^{+393.9}	2.76	5.19	.695 037 ^{+4 942}	15 39 42
18	19 24 52.80 ^{196.97}	23 31 33.5 ^{409.4}	2.75	5.18	.699 978 ^{4 941}	15 39 03
19	19 28 09.64 ^{196.84}	23 24 28.8 ^{424.7}	2.74	5.16	.704 919 ^{4 941}	15 38 23
20	19 31 26.33 ^{196.69}	23 17 08.7 ^{440.1}	2.74	5.15	.709 858 ^{4 939}	15 37 43
	^{196.54}	^{455.4}			^{4 940}	
21	19 34 42.87 ^{+196.37}	-23 09 33.3 ^{+470.5}	2.73	5.13	1.714 798 ^{+4 939}	15 37 03
22	19 37 59.24 ^{196.18}	23 01 42.8 ^{485.5}	2.72	5.12	.719 737 ^{4 940}	15 36 23
23	19 41 15.42 ^{195.98}	22 53 37.3 ^{500.6}	2.71	5.10	.724 677 ^{4 940}	15 35 42
24	19 44 31.40 ^{195.78}	22 45 16.7 ^{515.4}	2.71	5.09	.729 617 ^{4 941}	15 35 01
25	19 47 47.18 ^{195.55}	22 36 41.3 ^{530.3}	2.70	5.07	.734 558 ^{4 940}	15 34 21
26	19 51 02.73 ^{+195.33}	-22 27 51.0 ^{+544.9}	2.69	5.06	1.739 498 ^{+4 942}	15 33 39
27	19 54 18.06 ^{195.08}	22 18 46.1 ^{559.6}	2.68	5.04	.744 440 ^{4 941}	15 32 58
28	19 57 33.14 ^{194.84}	22 09 26.5 ^{574.1}	2.68	5.03	.749 381 ^{4 941}	15 32 16
29	20 00 47.98 ^{194.57}	21 59 52.4 ^{588.4}	2.67	5.02	.754 322 ^{4 941}	15 31 35
30	20 04 02.55 ^{194.31}	21 50 04.0 ^{602.8}	2.66	5.00	.759 263 ^{4 941}	15 30 52
Dec. 1	20 07 16.86 ^{+194.03}	-21 40 01.2 ^{+616.8}	2.65	4.99	1.764 204 ^{+4 939}	15 30 10
2	20 10 30.89 ^{193.73}	21 29 44.4 ^{630.8}	2.65	4.97	.769 143 ^{4 938}	15 29 27
3	20 13 44.62 ^{193.41}	21 19 13.6 ^{644.6}	2.64	4.96	.774 081 ^{4 938}	15 28 44
4	20 16 58.03 ^{193.09}	21 08 29.0 ^{658.2}	2.63	4.95	.779 019 ^{4 935}	15 28 01
5	20 20 11.12 ^{192.75}	20 57 30.8 ^{671.7}	2.62	4.93	.783 954 ^{4 935}	15 27 17
6	20 23 23.87 ^{+192.40}	-20 46 19.1 ^{+685.1}	2.62	4.92	1.788 889 ^{+4 933}	15 26 33
7	20 26 36.27 ^{192.03}	20 34 54.0 ^{698.2}	2.61	4.91	.793 822 ^{4 933}	15 25 49
8	20 29 48.30 ^{191.67}	20 23 15.8 ^{711.2}	2.60	4.89	.798 755 ^{4 932}	15 25 04
9	20 32 59.97 ^{191.28}	20 11 24.6 ^{724.1}	2.59	4.88	.803 687 ^{4 931}	15 24 19
10	20 36 11.25 ^{190.89}	19 59 20.5 ^{736.7}	2.59	4.87	.808 618 ^{4 931}	15 23 34
11	20 39 22.14 ^{+190.50}	-19 47 03.8 ^{+749.2}	2.58	4.85	1.813 549 ^{+4 932}	15 22 48
12	20 42 32.64 ^{190.10}	19 34 34.6 ^{761.6}	2.57	4.84	.818 481 ^{4 931}	15 22 01
13	20 45 42.74 ^{189.71}	19 21 53.0 ^{773.7}	2.57	4.83	.823 412 ^{4 933}	15 21 15
14	20 48 52.45 ^{189.29}	19 08 59.3 ^{785.7}	2.56	4.81	.828 345 ^{4 933}	15 20 28
15	20 52 01.74 ^{188.88}	18 55 53.6 ^{797.4}	2.55	4.80	.833 278 ^{4 935}	15 19 40
16	20 55 10.62 ^{+188.46}	-18 42 36.2 ^{+808.9}	2.55	4.79	1.838 213 ^{+4 937}	15 18 52
17	20 58 19.08 ^{188.04}	18 29 07.3 ^{820.4}	2.54	4.77	.843 150 ^{4 938}	15 18 04
18	21 01 27.12 ^{187.62}	18 15 26.9 ^{831.6}	2.53	4.76	.848 088 ^{4 940}	15 17 15
19	21 04 34.74 ^{187.20}	18 01 35.3 ^{842.6}	2.53	4.75	.853 028 ^{4 942}	15 16 26
20	21 07 41.94 ^{186.77}	17 47 32.7 ^{853.4}	2.52	4.74	.857 970 ^{4 945}	15 15 36
21	21 10 48.71 ^{+186.34}	-17 33 19.3 ^{+864.1}	2.51	4.72	1.862 915 ^{+4 947}	15 14 46
22	21 13 55.05 ^{185.91}	17 18 55.2 ^{874.5}	2.51	4.71	.867 862 ^{4 950}	15 13 56
23	21 17 00.96 ^{185.48}	17 04 20.7 ^{884.9}	2.50	4.70	.872 812 ^{4 952}	15 13 05
24	21 20 06.44 ^{185.06}	16 49 35.8 ^{894.9}	2.49	4.69	.877 764 ^{4 954}	15 12 14
25	21 23 11.50 ^{184.64}	16 34 40.9 ^{905.0}	2.49	4.67	.882 718 ^{4 956}	15 11 22
26	21 26 16.14 ^{+184.22}	-16 19 35.9 ^{+914.7}	2.48	4.66	1.887 674 ^{+4 958}	15 10 30
27	21 29 20.36 ^{183.81}	16 04 21.2 ^{924.2}	2.47	4.65	.892 632 ^{4 958}	15 09 37
28	21 32 24.17 ^{183.38}	15 48 57.0 ^{933.6}	2.47	4.64	.897 590 ^{4 960}	15 08 44
29	21 35 27.55 ^{182.97}	15 33 23.4 ^{942.8}	2.46	4.63	.902 550 ^{4 960}	15 07 51
30	21 38 30.52 ^{182.56}	15 17 40.6 ^{951.8}	2.45	4.61	.907 510 ^{4 959}	15 06 57
31	21 41 33.08 ^{+182.12}	-15 01 48.8 ^{+960.4}	2.45	4.60	1.912 469 ^{+4 960}	15 06 03
32	21 44 35.20	-14 45 48.4	2.44	4.59	1.917 429	15 05 08

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Jan. 0	8 17 38.972	+20 10 47.93	21.20	2.03	4.334 827	1 41 27
1	8 17 10.388	20 12 31.13	21.23	2.03	3.329 003	1 37 03
2	8 16 41.332	20 14 15.42	21.26	2.04	3.323 468	1 32 38
3	8 16 11.825	20 16 00.72	21.28	2.04	3.318 226	1 28 13
4	8 15 41.888	20 17 46.92	21.31	2.04	3.313 278	1 23 47
5	8 15 11.544	+20 19 33.95	21.33	2.04	4.308 630	1 19 21
6	8 14 40.816	20 21 21.72	21.35	2.04	3.304 282	1 14 54
7	8 14 09.727	20 23 10.15	21.37	2.05	3.300 238	1 10 28
8	8 13 38.299	20 24 59.17	21.39	2.05	2.296 500	1 06 00
9	8 13 06.556	20 26 48.69	21.41	2.05	2.293 070	1 01 33
10	8 12 34.520	+20 28 38.65	21.42	2.05	4.289 951	0 57 05
11	8 12 02.215	20 30 28.95	21.44	2.05	2.287 144	0 52 37
12	8 11 29.664	20 32 19.49	21.45	2.05	2.284 651	0 48 09
13	8 10 56.893	20 34 10.19	21.46	2.05	2.282 472	0 43 40
14	8 10 23.925	20 36 00.95	21.47	2.06	2.280 610	0 39 12
15	8 09 50.790	+20 37 51.66	21.48	2.06	4.279 065	0 34 43
16	8 09 17.510	20 39 42.23	21.49	2.06	2.277 838	0 30 14
17	8 08 44.116	20 41 32.59	21.49	2.06	2.276 928	0 25 45
18	8 08 10.632	20 43 22.63	21.49	2.06	2.276 337	0 21 15
19	8 07 37.085	20 45 12.26	21.49	2.06	2.276 064	0 16 46
20	8 07 03.503	+20 47 01.40	21.49	2.06	4.276 110	0 12 17
21	8 06 29.911	20 48 49.98	21.49	2.06	2.276 474	0 07 48
22	8 05 56.336	20 50 37.92	21.49	2.06	2.277 155	0 03 18
23	8 05 22.802	20 52 25.16	21.48	2.06	2.278 154	23 58 49
24	8 04 49.334	20 54 11.63	21.48	2.06	2.279 468	23 54 20
25	8 04 15.952	+20 55 57.25	21.47	2.06	4.281 099	23 49 51
26	8 03 42.682	20 57 41.99	21.46	2.05	2.283 043	23 45 22
27	8 03 09.543	20 59 25.76	21.45	2.05	2.285 302	23 40 53
28	8 02 36.559	21 01 08.49	21.43	2.05	2.287 873	23 36 24
29	8 02 03.753	21 02 50.11	21.42	2.05	2.290 755	23 31 56
30	8 01 31.149	+21 04 30.54	21.40	2.05	4.293 948	23 27 27
31	8 00 58.774	21 06 09.71	21.39	2.05	2.297 451	23 22 59
Feb. 1	8 00 26.653	21 07 47.56	21.37	2.05	3.301 262	23 18 31
2	7 59 54.812	21 09 24.04	21.35	2.04	3.305 379	23 14 04
3	7 59 23.275	21 10 59.11	21.33	2.04	3.309 802	23 09 37
4	7 58 52.066	+21 12 32.71	21.30	2.04	4.314 529	23 05 10
5	7 58 21.207	21 14 04.81	21.28	2.04	3.319 557	23 00 43
6	7 57 50.721	21 15 35.35	21.25	2.03	3.324 885	22 56 17
7	7 57 20.630	21 17 04.31	21.22	2.03	3.330 510	22 51 51
8	7 56 50.955	21 18 31.63	21.19	2.03	3.336 430	22 47 25
9	7 56 21.717	+21 19 57.25	21.16	2.03	4.342 642	22 43 00
10	7 55 52.938	21 21 21.14	21.13	2.02	3.349 142	22 38 36
11	7 55 24.641	21 22 43.23	21.10	2.02	3.355 928	22 34 12
12	7 54 56.845	21 24 03.48	21.07	2.02	3.362 997	22 29 48
13	7 54 29.571	21 25 21.86	21.03	2.01	3.370 345	22 25 25
14	7 54 02.839	+21 26 38.31	20.99	2.01	4.377 968	22 21 03
15	7 53 36.670	21 27 52.82	20.96	2.01	4.385 863	22 16 41

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Feb. 15	7 53 36.670	+21 27 52.82	20.96	2.01	4.385 863	22 12 19
16	7 53 11.081	21 29 05.35	20.92	2.00	.394 025 + 8 162	22 07 59
17	7 52 46.090	21 30 15.87	20.88	2.00	.402 451 8 426	22 03 38
18	7 52 21.713	21 31 24.37	20.84	1.99	.411 137 8 686	21 59 19
19	7 51 57.966	21 32 30.83	20.79	1.99	.420 079 8 942	21 55 00
					9 193	
20	7 51 34.862	+21 33 35.24	20.75	1.99	4.429 272	21 50 42
21	7 51 12.415	21 34 37.59	20.71	1.98	.438 712 + 9 440	21 46 24
22	7 50 50.635	21 35 37.87	20.66	1.98	.448 396 9 684	21 42 07
23	7 50 29.531	21 36 36.08	20.62	1.97	.458 317 9 921	21 37 51
24	7 50 09.115	21 37 32.19	20.57	1.97	.468 474 10 157	21 33 35
					10 387	
25	7 49 49.395	+21 38 26.19	20.52	1.96	4.478 861	21 29 20
26	7 49 30.382	21 39 18.06	20.47	1.96	.489 474 +10 613	21 25 06
27	7 49 12.088	21 40 07.77	20.42	1.96	.500 310 10 836	21 20 53
28	7 48 54.527	21 40 55.31	20.37	1.95	.511 363 11 053	21 16 40
Mar. 1	7 48 37.707	21 41 40.68	20.32	1.95	.522 631 11 268	21 12 28
					11 479	
2	7 48 21.640	+21 42 23.89	20.27	1.94	4.534 110	21 08 17
3	7 48 06.336	21 43 04.94	20.22	1.94	.545 794 +11 684	21 04 06
4	7 47 51.802	21 43 43.83	20.17	1.93	.557 680 11 886	20 59 57
5	7 47 38.043	21 44 20.58	20.11	1.93	.569 763 12 083	20 55 48
6	7 47 25.068	21 44 55.18	20.06	1.92	.582 039 12 276	20 51 40
					12 465	
7	7 47 12.882	+21 45 27.64	20.00	1.92	4.594 504	20 47 32
8	7 47 01.490	21 45 57.94	19.95	1.91	.607 151 +12 647	20 43 26
9	7 46 50.898	21 46 26.08	19.89	1.90	.619 977 12 826	20 39 20
10	7 46 41.111	21 46 52.05	19.84	1.90	.632 976 12 999	20 35 15
11	7 46 32.136	21 47 15.84	19.78	1.89	.646 144 13 168	20 31 11
					13 331	
12	7 46 23.975	+21 47 37.45	19.73	1.89	4.659 475	20 27 07
13	7 46 16.635	21 47 56.87	19.67	1.88	.672 965 +13 490	20 23 05
14	7 46 10.118	21 48 14.09	19.61	1.88	.686 608 13 643	20 19 03
15	7 46 04.427	21 48 29.15	19.55	1.87	.700 398 13 790	20 15 02
16	7 45 59.565	21 48 42.03	19.50	1.87	.714 332 13 934	20 11 02
					14 072	
17	7 45 55.532	+21 48 52.73	19.44	1.86	4.728 404	20 07 03
18	7 45 52.329	21 49 01.29	19.38	1.86	.742 608 +14 204	20 03 05
19	7 45 49.955	21 49 07.71	19.32	1.85	.756 940 14 332	19 59 07
20	7 45 48.408	21 49 12.00	19.26	1.84	.771 395 14 455	19 55 10
21	7 45 47.684	21 49 14.18	19.20	1.84	.785 966 14 571	19 51 14
					14 685	
22	7 45 47.780	+21 49 14.25	19.15	1.83	4.800 651	19 47 19
23	7 45 48.692	21 49 12.24	19.09	1.83	.815 443 +14 792	19 43 25
24	7 45 50.415	21 49 08.12	19.03	1.82	.830 339 14 896	19 39 31
25	7 45 52.945	21 49 01.92	18.97	1.82	.845 333 14 994	19 35 39
26	7 45 56.280	21 48 53.62	18.91	1.81	.860 422 15 089	19 31 47
					15 178	
27	7 46 00.419	+21 48 43.21	18.85	1.80	4.875 600	19 27 56
28	7 46 05.361	21 48 30.71	18.79	1.80	.800 864 +15 264	19 24 05
29	7 46 11.103	21 48 16.13	18.73	1.79	.906 210 15 346	19 20 16
30	7 46 17.644	21 47 59.49	18.67	1.79	.921 634 15 424	19 16 27
31	7 46 24.978	21 47 40.81	18.62	1.78	.937 130 15 496	19 12 39
					15 566	
Apr. 1	7 46 33.101	+21 47 20.11	18.56	1.78	4.952 696	19 08 52
2	7 46 42.007	+21 46 57.40	18.50	1.77	4.968 326 +15 630	19 05 05

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]				^h ^m ^s
Apr. 1	7 46 33.101 + 8.906	+21 47 20.11 - 22.71	18.56	1.78	4.952 696 +15 630	19 08 52
2	7 46 42.007 9.684	21 46 57.40 24.72	18.50	1.77	.968 326 15 690	19 05 05
3	7 46 51.691 10.458	21 46 32.68 26.73	18.44	1.77	.984 016 15 747	19 01 20
4	7 47 02.149 11.225	21 46 05.95 28.74	18.38	1.76	4.999 763 15 797	18 57 35
5	7 47 13.374 11.989	21 45 37.21 30.75	18.32	1.75	5.015 560 15 844	18 53 51
6	7 47 25.363 +12.747	+21 45 06.46 - 32.76	18.27	1.75	5.031 404 +15 887	18 50 07
7	7 47 38.110 13.502	21 44 33.70 34.79	18.21	1.74	.047 291 15 924	18 46 25
8	7 47 51.612 14.251	21 43 58.91 36.79	18.15	1.74	.063 215 15 957	18 42 43
9	7 48 05.863 14.995	21 43 22.12 38.82	18.10	1.73	.079 172 15 985	18 39 02
10	7 48 20.858 15.735	21 42 43.30 40.84	18.04	1.73	.095 157 16 010	18 35 21
11	7 48 36.593 +16.468	+21 42 02.46 - 42.84	17.98	1.72	5.111 167 +16 030	18 31 41
12	7 48 53.061 17.195	21 41 19.62 44.84	17.93	1.72	.127 197 16 045	18 28 02
13	7 49 10.256 17.914	21 40 34.78 46.82	17.87	1.71	.143 242 16 055	18 24 24
14	7 49 28.170 18.627	21 39 47.96 48.80	17.81	1.71	.159 297 16 063	18 20 47
15	7 49 46.797 19.330	21 38 59.16 50.77	17.76	1.70	.175 360 16 064	18 17 10
16	7 50 06.127 +20.024	+21 38 08.39 - 52.71	17.70	1.70	5.191 424 +16 063	18 13 34
17	7 50 26.151 20.708	21 37 15.68 54.65	17.65	1.69	.207 487 16 058	18 09 58
18	7 50 46.859 21.384	21 36 21.03 56.59	17.60	1.68	.223 545 16 047	18 06 23
19	7 51 08.243 22.048	21 35 24.44 58.52	17.54	1.68	.239 592 16 034	18 02 49
20	7 51 30.291 22.705	21 34 25.92 60.45	17.49	1.67	.255 626 16 017	17 59 16
21	7 51 52.996 +23.352	+21 33 25.47 - 62.39	17.43	1.67	5.271 643 +15 996	17 55 43
22	7 52 16.348 23.993	21 32 23.08 64.34	17.38	1.66	.287 639 15 973	17 52 11
23	7 52 40.341 24.628	21 31 18.74 66.28	17.33	1.66	.303 612 15 945	17 48 39
24	7 53 04.969 25.258	21 30 12.46 68.22	17.28	1.65	.319 557 15 915	17 45 08
25	7 53 30.227 25.881	21 29 04.24 70.15	17.23	1.65	.335 472 15 882	17 41 38
26	7 53 56.108 +26.497	+21 27 54.09 - 72.05	17.18	1.64	5.351 354 +15 846	17 38 08
27	7 54 22.605 27.104	21 26 42.04 73.94	17.12	1.64	.367 200 15 806	17 34 39
28	7 54 49.709 27.702	21 25 28.10 75.82	17.07	1.63	.383 006 15 763	17 31 11
29	7 55 17.411 28.291	21 24 12.28 77.68	17.02	1.63	.398 769 15 717	17 27 43
30	7 55 45.702 28.873	21 22 54.60 79.56	16.97	1.63	.414 486 15 668	17 24 15
May 1	7 56 14.575 +29.446	+21 21 35.04 - 81.45	16.93	1.62	5.430 154 +15 616	17 20 49
2	7 56 44.021 30.013	21 20 13.59 83.32	16.88	1.62	.445 770 15 560	17 17 22
3	7 57 14.034 30.572	21 18 50.27 85.22	16.83	1.61	.461 330 15 500	17 13 57
4	7 57 44.606 31.125	21 17 25.05 87.11	16.78	1.61	.476 830 15 438	17 10 32
5	7 58 15.731 31.671	21 15 57.94 89.01	16.73	1.60	.492 268 15 371	17 07 07
6	7 58 47.402 +32.211	+21 14 28.93 - 90.91	16.69	1.60	5.507 639 +15 303	17 03 43
7	7 59 19.613 32.743	21 12 58.02 92.82	16.64	1.59	.522 942 15 229	17 00 19
8	7 59 52.356 33.270	21 11 25.20 94.70	16.60	1.59	.538 171 15 154	16 56 57
9	8 00 25.626 33.788	21 09 50.50 96.60	16.55	1.58	.553 325 15 075	16 53 34
10	8 00 59.414 34.298	21 08 13.90 98.48	16.51	1.58	.568 400 14 992	16 50 12
11	8 01 33.712 +34.801	+21 06 35.42 - 100.36	16.46	1.58	5.583 392 +14 907	16 46 51
12	8 02 08.513 35.293	21 04 55.06 102.21	16.42	1.57	.598 299 14 819	16 43 30
13	8 02 43.806 35.777	21 03 12.85 104.06	16.37	1.57	.613 118 14 727	16 40 09
14	8 03 19.583 36.251	21 01 28.79 105.89	16.33	1.56	.627 845 14 632	16 36 49
15	8 03 55.834 36.714	20 59 42.90 107.73	16.29	1.56	.642 477 14 535	16 33 30
16	8 04 32.548 +37.167	+20 57 55.17 - 109.56	16.25	1.56	5.657 012 +14 436	16 30 11
17	8 05 09.715	+20 56 05.61	16.21	1.55	5.671 448	16 26 52

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
May 17	8 05 09.715	+20 56 05.61	16.21	1.55	5.671 448	16 26 52
18	8 05 47.327	20 54 14.23	16.16	1.55	.685 781	16 23 34
19	8 06 25.375	20 52 21.01	16.12	1.54	.700 009	16 20 16
20	8 07 03.852	20 50 25.96	16.08	1.54	.714 130	16 16 59
21	8 07 42.751	20 48 29.07	16.05	1.54	.728 143	16 13 42
22	8 08 22.068	+20 46 30.34	16.01	1.53	5.742 044	16 10 25
23	8 09 01.796	20 44 29.78	15.97	1.53	.755 831	16 07 09
24	8 09 41.930	20 42 27.43	15.93	1.53	.769 504	16 03 54
25	8 10 22.460	20 40 23.29	15.89	1.52	.783 060	16 00 38
26	8 11 03.379	20 38 17.37	15.86	1.52	.796 497	15 57 23
27	8 11 44.678	+20 36 09.70	15.82	1.51	5.809 812	15 54 09
28	8 12 26.349	20 34 00.27	15.78	1.51	.823 005	15 50 54
29	8 13 08.385	20 31 49.07	15.75	1.51	.836 072	15 47 41
30	8 13 50.780	20 29 36.12	15.71	1.50	.849 012	15 44 27
31	8 14 33.527	20 27 21.41	15.68	1.50	.861 821	15 41 14
June 1	8 15 16.621	+20 25 04.92	15.65	1.50	5.874 499	15 38 01
2	8 16 00.055	20 22 46.65	15.61	1.49	.887 042	15 34 49
3	8 16 43.825	20 20 26.62	15.58	1.49	.899 449	15 31 37
4	8 17 27.925	20 18 04.81	15.55	1.49	.911 716	15 28 25
5	8 18 12.349	20 15 41.25	15.52	1.49	.923 843	15 25 13
6	8 18 57.092	+20 13 15.92	15.48	1.48	5.935 826	15 22 02
7	8 19 42.146	20 10 48.85	15.45	1.48	.947 663	15 18 51
8	8 20 27.504	20 08 20.05	15.42	1.48	.959 354	15 15 41
9	8 21 13.160	20 05 49.53	15.39	1.47	.970 894	15 12 30
10	8 21 59.104	20 03 17.32	15.36	1.47	.982 282	15 09 20
11	8 22 45.329	+20 00 43.43	15.33	1.47	5.993 517	15 06 11
12	8 23 31.825	19 58 07.86	15.31	1.47	6.004 596	15 03 01
13	8 24 18.584	19 55 30.62	15.28	1.46	.015 519	14 59 52
14	8 25 05.599	19 52 51.74	15.25	1.46	.026 282	14 56 43
15	8 25 52.861	19 50 11.21	15.22	1.46	.036 885	14 53 34
16	8 26 40.365	+19 47 29.01	15.20	1.46	6.047 326	14 50 26
17	8 27 28.107	19 44 45.17	15.17	1.45	.057 604	14 47 17
18	8 28 16.080	19 41 59.68	15.15	1.45	.067 718	14 44 09
19	8 29 04.282	19 39 12.57	15.12	1.45	.077 667	14 41 02
20	8 29 52.706	19 36 23.84	15.10	1.45	.087 449	14 37 54
21	8 30 41.347	+19 33 33.53	15.07	1.44	6.097 064	14 34 47
22	8 31 30.199	19 30 41.65	15.05	1.44	.106 511	14 31 39
23	8 32 19.253	19 27 48.22	15.03	1.44	.115 789	14 28 32
24	8 33 08.503	19 24 53.26	15.01	1.44	.124 896	14 25 26
25	8 33 57.944	19 21 56.78	14.98	1.43	.133 831	14 22 19
26	8 34 47.568	+19 18 58.78	14.96	1.43	6.142 593	14 19 13
27	8 35 37.372	19 15 59.26	14.94	1.43	.151 180	14 16 06
28	8 36 27.350	19 12 58.22	14.92	1.43	.159 592	14 13 00
29	8 37 17.499	19 09 55.66	14.90	1.43	.167 826	14 09 54
30	8 38 07.815	19 06 51.59	14.88	1.42	.175 882	14 06 49
July 1	8 38 58.293	+19 03 46.01	14.86	1.42	6.183 758	14 03 43
2	8 39 48.930	+19 00 38.94	14.84	1.42	6.191 452	14 00 38

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
July	^{h m s} 8 38 58.293	^{° ' "} +19 03 46.01	^{° ' "} 14.86	^{° ' "} 1.42	^{° ' "} 6.183 758	^{h m s} 14 03 43
2	8 39 48.930 +50.637	19 00 38.94 -187.07	14.84	1.42	191 452 + 7 694	14 00 38
3	8 40 39.720 50.790	18 57 30.40 188.54	14.83	1.42	198 964 7 512	13 57 32
4	8 41 30.658 50.938	18 54 20.38 190.02	14.81	1.42	206 291 7 327	13 54 27
5	8 42 21.740 51.082	18 51 08.93 191.45	14.79	1.42	213 433 7 142	13 51 22
	51.219	192.89			6 955	
6	8 43 12.959	+18 47 56.04	14.78	1.41	6.220 388	13 48 17
7	8 44 04.308 +51.349	18 44 41.76 -194.28	14.76	1.41	227 155 + 6 767	13 45 13
8	8 44 55.781 51.473	18 41 26.10 195.66	14.74	1.41	233 733 6 578	13 42 08
9	8 45 47.371 51.590	18 38 09.10 197.00	14.73	1.41	240 120 6 387	13 39 03
10	8 46 39.069 51.698	18 34 50.75 198.35	14.71	1.41	246 316 6 196	13 35 59
	51.799	199.67			6 003	
11	8 47 30.868	+18 31 31.08	14.70	1.41	6.252 319	13 32 55
12	8 48 22.764 +51.896	18 28 10.10 -200.98	14.69	1.41	258 130 + 5 811	13 29 50
13	8 49 14.750 51.986	18 24 47.81 202.29	14.67	1.40	263 746 5 616	13 26 46
14	8 50 06.822 52.072	18 21 24.23 203.58	14.66	1.40	269 169 5 423	13 23 42
15	8 50 58.978 52.156	18 17 59.37 204.86	14.65	1.40	274 397 5 228	13 20 38
	52.235	206.11			5 032	
16	8 51 51.213	+18 14 33.26	14.64	1.40	6.279 429	13 17 34
17	8 52 43.523 +52.310	18 11 05.90 -207.36	14.63	1.40	284 267 + 4 838	13 14 31
18	8 53 35.905 52.382	18 07 37.33 208.57	14.61	1.40	288 908 4 641	13 11 27
19	8 54 28.351 52.446	18 04 07.58 209.75	14.60	1.40	293 354 4 446	13 08 23
20	8 55 20.857 52.506	18 00 36.69 210.89	14.59	1.40	297 603 4 249	13 05 20
	52.559	212.03			4 053	
21	8 56 13.416	+17 57 04.66	14.59	1.40	6.301 656	13 02 16
22	8 57 06.023 +52.607	17 53 31.53 -213.13	14.58	1.40	305 511 + 3 855	12 59 12
23	8 57 58.673 52.650	17 49 57.29 214.24	14.57	1.39	309 169 3 658	12 56 09
24	8 58 51.361 52.688	17 46 21.97 215.32	14.56	1.39	312 629 3 460	12 53 05
25	8 59 44.084 52.723	17 42 45.57 216.40	14.55	1.39	315 890 3 261	12 50 02
	52.755	217.46			3 061	
26	9 00 36.839	+17 39 08.11	14.55	1.39	6.318 951	12 46 59
27	9 01 29.623 +52.784	17 35 29.58 -218.53	14.54	1.39	321 813 + 2 862	12 43 55
28	9 02 22.432 52.809	17 31 50.02 219.56	14.53	1.39	324 473 2 660	12 40 52
29	9 03 15.263 52.831	17 28 09.42 220.60	14.53	1.39	326 932 2 459	12 37 49
30	9 04 08.112 52.849	17 24 27.82 221.60	14.52	1.39	329 190 2 258	12 34 45
	52.863	222.59			2 054	
31	9 05 00.975	+17 20 45.23	14.52	1.39	6.331 244	12 31 42
Aug.	1 9 05 53.849 +52.874	17 17 01.68 -223.55	14.51	1.39	333 095 + 1 851	12 28 39
2	9 06 46.729 52.880	17 13 17.19 224.49	14.51	1.39	334 742 1 647	12 25 35
3	9 07 39.607 52.878	17 09 31.80 225.39	14.51	1.39	336 185 1 443	12 22 32
4	9 08 32.479 52.872	17 05 45.54 226.26	14.50	1.39	337 422 1 237	12 19 29
	52.859	227.10			1 032	
5	9 09 25.338	+17 01 58.44	14.50	1.39	6.338 454	12 16 25
6	9 10 18.178 +52.840	16 58 10.53 -227.91	14.50	1.39	339 280 + 826	12 13 22
7	9 11 10.992 52.814	16 54 21.84 228.69	14.50	1.39	339 899 619	12 10 19
8	9 12 03.772 52.780	16 50 32.39 229.45	14.50	1.39	340 313 414	12 07 15
9	9 12 56.517 52.745	16 46 42.19 230.20	14.50	1.39	340 519 206	12 04 12
	52.703	230.94			+	
10	9 13 49.220	+16 42 51.25	14.50	1.39	6.340 520	12 01 09
11	9 14 41.880 +52.660	16 38 59.61 -231.64	14.50	1.39	340 314 - 206	11 58 05
12	9 15 34.493 52.613	16 35 07.28 232.33	14.50	1.39	339 903 411	11 55 01
13	9 16 27.055 52.562	16 31 14.31 232.97	14.50	1.39	339 286 617	11 51 58
14	9 17 19.563 52.508	16 27 20.71 233.60	14.50	1.39	338 464 822	11 48 54
	52.448	234.18			1 026	
15	9 18 12.011	+16 23 26.53	14.50	1.39	6.337 438	11 45 50
16	9 19 04.394 +52.383	+16 19 31.81 -234.72	14.51	1.39	6.336 208 - 1 230	11 42 46

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FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	[°] ['] ["]		^h ^m ^s
Aug. 16	9 19 04.394	+16 19 31.81	14.51	1.39	6.336 208	11 42 46
17	9 19 56.706	16 15 36.58	14.51	1.39	.334 773	11 39 43
18	9 20 48.943	16 11 40.87	14.51	1.39	.333 135	11 36 39
19	9 21 41.099	16 07 44.71	14.52	1.39	.331 294	11 33 35
20	9 22 33.170	16 03 48.10	14.52	1.39	.329 250	11 30 30
21	9 23 25.152	+15 59 51.08	14.53	1.39	6.327 004	11 27 26
22	9 24 17.043	15 55 53.65	14.53	1.39	.324 554	11 24 22
23	9 25 08.839	15 51 55.83	14.54	1.39	.321 902	11 21 17
24	9 26 00.537	15 47 57.65	14.54	1.39	.319 047	11 18 13
25	9 26 52.136	15 43 59.14	14.55	1.39	.315 990	11 15 08
26	9 27 43.630	+15 40 00.31	14.56	1.39	6.312 731	11 12 04
27	9 28 35.016	15 36 01.20	14.57	1.39	.309 269	11 08 59
28	9 29 26.291	15 32 01.84	14.58	1.40	.305 605	11 05 54
29	9 30 17.449	15 28 02.25	14.58	1.40	.301 739	11 02 49
30	9 31 08.486	15 24 02.49	14.59	1.40	.297 671	10 59 44
31	9 31 59.396	+15 20 02.59	14.60	1.40	6.293 401	10 56 38
Sept. 1	9 32 50.172	15 16 02.58	14.61	1.40	.288 930	10 53 33
2	9 33 40.809	15 12 02.52	14.63	1.40	.284 258	10 50 27
3	9 34 31.299	15 08 02.44	14.64	1.40	.279 384	10 47 22
4	9 35 21.637	15 04 02.37	14.65	1.40	.274 311	10 44 16
5	9 36 11.815	+15 00 02.34	14.66	1.40	6.269 038	10 41 10
6	9 37 01.832	14 56 02.38	14.67	1.40	.263 566	10 38 03
7	9 37 51.682	14 52 02.50	14.69	1.41	.257 896	10 34 57
8	9 38 41.363	14 48 02.76	14.70	1.41	.252 030	10 31 51
9	9 39 30.872	14 44 03.17	14.72	1.41	.245 967	10 28 44
10	9 40 20.202	+14 40 03.79	14.73	1.41	6.239 711	10 25 37
11	9 41 09.351	14 36 04.67	14.75	1.41	.233 261	10 22 30
12	9 41 58.311	14 32 05.85	14.76	1.41	.226 619	10 19 23
13	9 42 47.076	14 28 07.38	14.78	1.41	.219 786	10 16 15
14	9 43 35.641	14 24 09.28	14.79	1.42	.212 764	10 13 07
15	9 44 24.002	+14 20 11.61	14.81	1.42	6.205 553	10 10 00
16	9 45 12.152	14 16 14.39	14.83	1.42	.198 155	10 06 51
17	9 46 00.088	14 12 17.65	14.85	1.42	.190 571	10 03 43
18	9 46 47.807	14 08 21.40	14.87	1.42	.182 801	10 00 35
19	9 47 35.303	14 04 25.69	14.88	1.43	.174 847	9 57 26
20	9 48 22.575	+14 00 30.54	14.90	1.43	6.166 710	9 54 17
21	9 49 09.620	13 56 35.98	14.92	1.43	.158 390	9 51 08
22	9 49 56.432	13 52 42.05	14.94	1.43	.149 889	9 47 58
23	9 50 43.008	13 48 48.77	14.97	1.43	.141 207	9 44 49
24	9 51 29.343	13 44 56.20	14.99	1.44	.132 346	9 41 39
25	9 52 15.433	+13 41 04.37	15.01	1.44	6.123 307	9 38 29
26	9 53 01.272	13 37 13.33	15.03	1.44	.114 090	9 35 18
27	9 53 46.854	13 33 23.13	15.06	1.44	.104 696	9 32 08
28	9 54 32.171	13 29 33.81	15.08	1.44	.095 128	9 28 57
29	9 55 17.219	13 25 45.43	15.10	1.45	.085 386	9 25 46
30	9 56 01.988	+13 21 58.03	15.13	1.45	6.075 471	9 22 34
Oct. 1	9 56 46.472	+13 18 11.66	15.15	1.45	6.065 385	9 19 22

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]				^h ^m ^s
Oct. 1	9 56 46.472 ^s +44.194	+13 18 11.66 ["] -225.30	15.15	1.45	6.065 385 ^{-10 257}	9 19 22
2	9 57 30.666 43.895	13 14 26.36 224.18	15.18	1.45	.055 128 10 424	9 16 10
3	9 58 14.561 43.594	13 10 42.18 223.05	15.21	1.46	.044 704 10 591	9 12 58
4	9 58 58.155 43.288	13 06 59.13 221.85	15.23	1.46	.034 113 10 755	9 09 45
5	9 59 41.443 42.977	13 03 17.28 220.64	15.26	1.46	.023 358 10 917	9 06 32
6	10 00 24.420 +42.662	+12 59 36.64 -219.36	15.29	1.46	6.012 441 -11 078	9 03 19
7	10 01 07.082 42.341	12 55 57.28 218.02	15.31	1.47	6.001 363 11 235	9 00 05
8	10 01 49.423 42.013	12 52 19.26 216.63	15.34	1.47	5.990 128 11 392	8 56 52
9	10 02 31.436 41.678	12 48 42.63 215.18	15.37	1.47	.978 736 11 544	8 53 37
10	10 03 13.114 41.335	12 45 07.45 213.68	15.40	1.47	.967 192 11 695	8 50 23
11	10 03 54.449 +40.988	+12 41 33.77 -212.15	15.43	1.48	5.955 497 -11 844	8 47 08
12	10 04 35.437 40.633	12 38 01.62 210.56	15.46	1.48	.943 653 11 991	8 43 53
13	10 05 16.070 40.275	12 34 31.06 208.93	15.49	1.48	.931 662 12 135	8 40 37
14	10 05 56.345 39.911	12 31 02.13 207.28	15.53	1.49	.919 527 12 277	8 37 21
15	10 06 36.256 39.543	12 27 34.85 205.61	15.56	1.49	.907 250 12 418	8 34 05
16	10 07 15.799 +39.170	+12 24 09.24 -203.86	15.59	1.49	5.894 832 -12 556	8 30 48
17	10 07 54.969 38.793	12 20 45.38 202.11	15.62	1.50	.882 276 12 693	8 27 31
18	10 08 33.762 38.412	12 17 23.27 200.30	15.66	1.50	.869 583 12 826	8 24 13
19	10 09 12.174 38.025	12 14 02.97 198.45	15.69	1.50	.856 757 12 959	8 20 56
20	10 09 50.199 37.633	12 10 44.52 196.56	15.73	1.51	.843 798 13 088	8 17 38
21	10 10 27.832 +37.236	+12 07 27.96 -194.62	15.76	1.51	5.830 710 -13 216	8 14 19
22	10 11 05.068 36.831	12 04 13.34 192.62	15.80	1.51	.817 494 13 342	8 11 00
23	10 11 41.899 36.421	12 01 00.72 190.57	15.84	1.52	.804 152 13 465	8 07 40
24	10 12 18.320 36.002	11 57 50.15 188.47	15.87	1.52	.790 687 13 585	8 04 21
25	10 12 54.322 35.575	11 54 41.68 186.31	15.91	1.52	.777 102 13 705	8 01 00
26	10 13 29.897 +35.142	+11 51 35.37 -184.09	15.95	1.53	5.763 397 -13 821	7 57 40
27	10 14 05.039 34.700	11 48 31.28 181.83	15.99	1.53	.749 576 13 935	7 54 19
28	10 14 39.739 34.250	11 45 29.45 179.50	16.02	1.53	.735 641 14 046	7 50 57
29	10 15 13.989 33.794	11 42 29.95 177.14	16.06	1.54	.721 595 14 155	7 47 35
30	10 15 47.783 33.331	11 39 32.81 174.71	16.10	1.54	.707 440 14 260	7 44 13
31	10 16 21.114 +32.862	+11 36 38.10 -172.26	16.14	1.55	5.693 180 -14 362	7 40 50
Nov. 1	10 16 53.976 32.389	11 33 45.84 169.76	16.18	1.55	.678 818 14 462	7 37 27
2	10 17 26.365 31.910	11 30 56.08 167.20	16.23	1.55	.664 356 14 558	7 34 03
3	10 17 58.275 31.424	11 28 08.88 164.60	16.27	1.56	.649 798 14 650	7 30 38
4	10 18 29.699 30.932	11 25 24.28 161.92	16.31	1.56	.635 148 14 739	7 27 14
5	10 19 00.631 +30.430	+11 22 42.36 -159.18	16.35	1.57	5.620 409 -14 824	7 23 48
6	10 19 31.061 29.921	11 20 03.18 156.38	16.40	1.57	.605 585 14 906	7 20 22
7	10 20 00.982 29.404	11 17 26.80 153.54	16.44	1.57	.590 679 14 984	7 16 56
8	10 20 30.386 28.881	11 14 53.26 150.64	16.48	1.58	.575 695 15 059	7 13 29
9	10 20 59.267 28.352	11 12 22.62 147.70	16.53	1.58	.560 636 15 130	7 10 02
10	10 21 27.619 +27.817	+11 09 54.92 -144.74	16.57	1.59	5.545 506 -15 198	7 06 34
11	10 21 55.436 27.278	11 07 30.18 141.73	16.62	1.59	.530 308 15 262	7 03 06
12	10 22 22.714 26.734	11 05 08.45 138.69	16.67	1.60	.515 046 15 323	6 59 37
13	10 22 49.448 26.184	11 02 49.76 135.60	16.71	1.60	.499 723 15 381	6 56 07
14	10 23 15.632 25.630	11 00 34.16 132.49	16.76	1.60	.484 342 15 434	6 52 37
15	10 23 41.262 +25.071	+10 58 21.67 -129.32	16.81	1.61	5.468 908 -15 486	6 49 07
16	10 24 06.333	+10 56 12.35	16.85	1.61	5.453 422	6 45 36

JUPITER, 1967

FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov. 16	10 24 06.333	+10 56 12.35	16.85	1.61	5.453 422	6 45 36
17	10 24 30.838	10 54 06.23	16.90	1.62	5.437 888	6 42 04
18	10 24 54.773	10 52 03.36	16.95	1.62	5.422 311	6 38 32
19	10 25 18.131	10 50 03.79	17.00	1.63	5.406 693	6 34 59
20	10 25 40.903	10 48 07.58	17.05	1.63	5.391 038	6 31 25
21	10 26 03.084	+10 46 14.76	17.10	1.64	5.375 350	6 27 51
22	10 26 24.665	10 44 25.41	17.15	1.64	5.359 632	6 24 17
23	10 26 45.639	10 42 39.56	17.20	1.65	5.343 888	6 20 42
24	10 27 05.999	10 40 57.26	17.25	1.65	5.328 121	6 17 06
25	10 27 25.735	10 39 18.57	17.30	1.66	5.312 336	6 13 29
26	10 27 44.842	+10 37 43.54	17.35	1.66	5.296 537	6 09 52
27	10 28 03.314	10 36 12.18	17.40	1.67	5.280 727	6 06 15
28	10 28 21.145	10 34 44.55	17.46	1.67	5.264 911	6 02 36
29	10 28 38.329	10 33 20.68	17.51	1.68	5.249 094	5 58 57
30	10 28 54.863	10 32 00.60	17.56	1.68	5.233 280	5 55 18
Dec. 1	10 29 10.742	+10 30 44.37	17.62	1.69	5.217 474	5 51 37
2	10 29 25.959	10 29 32.02	17.67	1.69	5.201 680	5 47 56
3	10 29 40.508	10 28 23.61	17.72	1.70	5.185 903	5 44 15
4	10 29 54.380	10 27 19.19	17.78	1.70	5.170 149	5 40 32
5	10 30 07.570	10 26 18.80	17.83	1.71	5.154 423	5 36 50
6	10 30 20.072	+10 25 22.48	17.89	1.71	5.138 728	5 33 06
7	10 30 31.882	10 24 30.23	17.94	1.72	5.123 070	5 29 22
8	10 30 42.996	10 23 42.09	18.00	1.72	5.107 453	5 25 37
9	10 30 53.412	10 22 58.06	18.05	1.73	5.091 883	5 21 51
10	10 31 03.127	10 22 18.16	18.11	1.73	5.076 363	5 18 04
11	10 31 12.137	+10 21 42.41	18.16	1.74	5.060 898	5 14 17
12	10 31 20.442	10 21 10.82	18.22	1.74	5.045 493	5 10 30
13	10 31 28.039	10 20 43.39	18.27	1.75	5.030 153	5 06 41
14	10 31 34.924	10 20 20.16	18.33	1.75	5.014 881	5 02 52
15	10 31 41.096	10 20 01.14	18.38	1.76	4.999 683	4 59 02
16	10 31 46.551	+10 19 46.34	18.44	1.77	4.984 563	4 55 11
17	10 31 51.286	10 19 35.78	18.49	1.77	4.969 525	4 51 20
18	10 31 55.297	10 19 29.49	18.55	1.78	4.954 574	4 47 28
19	10 31 58.581	10 19 27.48	18.61	1.78	4.939 715	4 43 35
20	10 32 01.134	10 19 29.78	18.66	1.79	4.924 953	4 39 42
21	10 32 02.953	+10 19 36.39	18.72	1.79	4.910 291	4 35 47
22	10 32 04.034	10 19 47.33	18.77	1.80	4.895 735	4 31 52
23	10 32 04.375	10 20 02.60	18.83	1.80	4.881 290	4 27 57
24	10 32 03.975	10 20 22.19	18.88	1.81	4.866 961	4 24 00
25	10 32 02.834	10 20 46.12	18.94	1.81	4.852 752	4 20 03
26	10 32 00.952	+10 21 14.35	18.99	1.82	4.838 669	4 16 05
27	10 31 58.329	10 21 46.90	19.05	1.82	4.824 717	4 12 06
28	10 31 54.967	10 22 23.74	19.10	1.83	4.810 901	4 08 07
29	10 31 50.868	10 23 04.88	19.16	1.83	4.797 228	4 04 07
30	10 31 46.029	10 23 50.32	19.21	1.84	4.783 701	4 00 06
31	10 31 40.453	+10 24 40.04	19.27	1.84	4.770 328	3 56 05
32	10 31 34.138	+10 25 34.05	19.32	1.85	4.757 112	3 52 02

SATURN, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	[°] ['] ["]		^h ^m ^s
Jan. 0	23 41 19.928 +12.881	4 27 02.21 + 95.68	7.66 0.90	0.90	9.736 512 +15 985	17 02 48
1	23 41 32.809 13.218	4 25 26.53 97.75	7.65 0.90	.90	.752 497 15 910	16 59 05
2	23 41 46.027 13.553	4 23 48.78 99.83	7.63 0.90	.90	.768 407 15 833	16 55 23
3	23 41 59.580 13.886	4 22 08.95 101.88	7.62 0.90	.90	.784 240 15 749	16 51 40
4	23 42 13.466 14.219	4 20 27.07 103.93	7.61 0.90	.90	.799 989 15 662	16 47 58
5	23 42 27.685 +14.548	4 18 43.14 +105.97	7.60 0.90	0.90	9.815 651 +15 571	16 44 17
6	23 42 42.233 14.878	4 16 57.17 107.99	7.59 0.90	.90	.831 222 15 474	16 40 36
7	23 42 57.111 15.201	4 15 09.18 109.98	7.57 0.89	.89	.846 696 15 374	16 36 55
8	23 43 12.312 15.521	4 13 19.20 111.93	7.56 0.89	.89	.862 070 15 269	16 33 14
9	23 43 27.833 15.837	4 11 27.27 113.87	7.55 0.89	.89	.877 339 15 159	16 29 34
10	23 43 43.670 +16.146	4 09 33.40 +115.74	7.54 0.89	0.89	9.892 498 +15 046	16 25 54
11	23 43 59.816 16.450	4 07 37.66 117.60	7.53 0.89	.89	.907 544 14 928	16 22 14
12	23 44 16.266 16.751	4 05 40.06 119.44	7.52 0.89	.89	.922 472 14 806	16 18 35
13	23 44 33.017 17.045	4 03 40.62 121.22	7.50 0.89	.89	.937 278 14 679	16 14 56
14	23 44 50.062 17.338	4 01 39.40 122.99	7.49 0.88	.88	.951 957 14 550	16 11 17
15	23 45 07.400 +17.626	3 59 36.41 +124.73	7.48 0.88	0.88	9.966 507 +14 415	16 07 39
16	23 45 25.026 17.912	3 57 31.68 126.46	7.47 0.88	.88	.980 922 14 278	16 04 01
17	23 45 42.938 18.193	3 55 25.22 128.16	7.46 0.88	.88	9.995 200 14 137	16 00 23
18	23 46 01.131 18.471	3 53 17.06 129.82	7.45 0.88	.88	10.009 337 13 992	15 56 45
19	23 46 19.602 18.745	3 51 07.24 131.48	7.44 0.88	.88	.023 329 13 845	15 53 08
20	23 46 38.347 +19.016	3 48 55.76 +133.10	7.43 0.88	0.88	10.037 174 +13 693	15 49 31
21	23 46 57.363 19.284	3 46 42.66 134.68	7.42 0.88	.88	.050 867 13 538	15 45 54
22	23 47 16.647 19.545	3 44 27.98 136.25	7.41 0.87	.87	.064 405 13 382	15 42 17
23	23 47 36.192 19.803	3 42 11.73 137.78	7.40 0.87	.87	.077 787 13 220	15 38 41
24	23 47 55.995 20.056	3 39 53.95 139.26	7.39 0.87	.87	.091 007 13 058	15 35 05
25	23 48 16.051 +20.301	3 37 34.69 +140.72	7.38 0.87	0.87	10.104 065 +12 891	15 31 29
26	23 48 36.352 20.542	3 35 13.97 142.13	7.37 0.87	.87	.116 956 12 723	15 27 53
27	23 48 56.894 20.779	3 32 51.84 143.51	7.36 0.87	.87	.129 679 12 552	15 24 18
28	23 49 17.673 21.010	3 30 28.33 144.88	7.35 0.87	.87	.142 231 12 377	15 20 43
29	23 49 38.683 21.241	3 28 03.45 146.21	7.34 0.87	.87	.154 608 12 200	15 17 08
30	23 49 59.924 +21.468	3 25 37.24 +147.54	7.33 0.87	0.87	10.166 808 +12 021	15 13 34
Feb. 1	23 50 21.392 21.694	3 23 09.70 148.87	7.33 0.86	.86	.178 829 11 837	15 09 59
2	23 51 05.005 21.919	3 20 40.83 150.16	7.32 0.86	.86	.190 666 11 652	15 06 25
3	23 51 27.143 22.138	3 18 10.67 151.44	7.31 0.86	.86	.202 318 11 463	15 02 51
4	23 51 49.497 22.354	3 15 39.23 152.68	7.30 0.86	.86	.213 781 11 271	14 59 17
5	23 51 49.497 +22.564	3 13 06.55 +153.90	7.29 0.86	0.86	10.225 052 +11 076	14 55 44
6	23 52 12.061 22.770	3 10 32.65 155.08	7.28 0.86	.86	.236 128 10 879	14 52 10
7	23 52 34.831 22.971	3 07 57.57 156.21	7.28 0.86	.86	.247 007 10 679	14 48 37
8	23 52 57.802 23.164	3 05 21.36 157.32	7.27 0.86	.86	.257 686 10 475	14 45 04
9	23 53 20.966 23.354	3 02 44.04 158.39	7.26 0.86	.86	.268 161 10 269	14 41 32
10	23 53 44.320 +23.537	3 00 05.65 +159.42	7.25 0.86	0.86	10.278 430 +10 061	14 37 59
11	23 54 07.857 23.717	2 57 26.23 160.42	7.25 0.86	.86	.288 491 9 850	14 34 27
12	23 54 31.574 23.893	2 54 45.81 161.40	7.24 0.85	.85	.298 341 9 637	14 30 54
13	23 54 55.467 24.064	2 52 04.41 162.35	7.23 0.85	.85	.307 978 9 422	14 27 22
14	23 55 19.531 24.234	2 49 22.06 163.27	7.23 0.85	.85	.317 400 9 204	14 23 50
15	23 55 43.765 +24.397	2 46 38.79 +164.18	7.22 0.85	0.85	10.326 604 + 8 985	14 20 19
16	23 56 08.162	2 43 54.61	7.21 0.85	.85	10.335 589	14 16 47

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Feb. 15	23 56 08.162	- 2 43 54.61	7.21	0.85	10.335 589	14 16 47
16	23 56 32.719	2 41 09.57	7.21	.85	.344 353	14 13 16
17	23 56 57.433	2 38 23.68	7.20	.85	.352 893	14 09 45
18	23 57 22.300	2 35 36.97	7.20	.85	.361 210	14 06 14
19	23 57 47.315	2 32 49.48	7.19	.85	.369 300	14 02 43
20	23 58 12.472	- 2 30 01.25	7.19	0.85	10.377 163	13 59 12
21	23 58 37.767	2 27 12.30	7.18	.85	.384 797	13 55 41
22	23 59 03.193	2 24 22.67	7.18	.85	.392 202	13 52 11
23	23 59 28.745	2 21 32.41	7.17	.85	.399 375	13 48 40
24	23 59 54.419	2 18 41.55	7.17	.85	.406 316	13 45 10
25	0 00 20.209	- 2 15 50.11	7.16	0.85	10.413 024	13 41 40
26	0 00 46.111	2 12 58.13	7.16	.84	.419 497	13 38 10
27	0 01 12.125	2 10 05.61	7.15	.84	.425 735	13 34 40
28	0 01 38.248	2 07 12.56	7.15	.84	.431 736	13 31 10
Mar. 1	0 02 04.479	2 04 19.00	7.14	.84	.437 499	13 27 40
2	0 02 30.815	- 2 01 24.95	7.14	0.84	10.443 022	13 24 10
3	0 02 57.250	1 58 30.44	7.14	.84	.448 305	13 20 41
4	0 03 23.782	1 55 35.49	7.13	.84	.453 345	13 17 11
5	0 03 50.403	1 52 40.16	7.13	.84	.458 141	13 13 42
6	0 04 17.108	1 49 44.46	7.13	.84	.462 693	13 10 13
7	0 04 43.893	- 1 46 48.45	7.12	0.84	10.466 998	13 06 43
8	0 05 10.752	1 43 52.15	7.12	.84	.471 057	13 03 14
9	0 05 37.679	1 40 55.59	7.12	.84	.474 867	12 59 45
10	0 06 04.671	1 37 58.81	7.12	.84	.478 428	12 56 16
11	0 06 31.724	1 35 01.83	7.11	.84	.481 739	12 52 47
12	0 06 58.834	- 1 32 04.68	7.11	0.84	10.484 800	12 49 18
13	0 07 25.998	1 29 07.38	7.11	.84	.487 611	12 45 50
14	0 07 53.211	1 26 09.97	7.11	.84	.490 169	12 42 21
15	0 08 20.471	1 23 12.46	7.11	.84	.492 477	12 38 52
16	0 08 47.772	1 20 14.88	7.11	.84	.494 532	12 35 23
17	0 09 15.113	- 1 17 17.26	7.10	0.84	10.496 335	12 31 55
18	0 09 42.488	1 14 19.63	7.10	.84	.497 887	12 28 26
19	0 10 09.892	1 11 22.01	7.10	.84	.499 187	12 24 57
20	0 10 37.320	1 08 24.46	7.10	.84	.500 235	12 21 29
21	0 11 04.767	1 05 26.99	7.10	.84	.501 031	12 18 00
22	0 11 32.229	- 1 02 29.64	7.10	0.84	10.501 577	12 14 31
23	0 11 59.698	0 59 32.45	7.10	.84	.501 872	12 11 03
24	0 12 27.172	0 56 35.46	7.10	.84	.501 918	12 07 34
25	0 12 54.645	0 53 38.69	7.10	.84	.501 713	12 04 06
26	0 13 22.116	0 50 42.14	7.10	.84	.501 260	12 00 37
27	0 13 49.584	- 0 47 45.84	7.10	0.84	10.500 557	11 57 08
28	0 14 17.046	0 44 49.79	7.10	.84	.499 606	11 53 40
29	0 14 44.501	0 41 54.01	7.10	.84	.498 406	11 50 11
30	0 15 11.945	0 38 58.52	7.10	.84	.496 958	11 46 43
31	0 15 39.374	0 36 03.34	7.11	.84	.495 262	11 43 14
Apr. 1	0 16 06.784	- 0 33 08.51	7.11	0.84	10.493 318	11 39 45
2	0 16 34.167	0 30 14.07	7.11	0.84	10.491 125	11 36 17

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°] ['] ["]	["]		^h ^m ^s
Apr. 1	0 16 06.784	- 0 33 08.51	7.11	0.84	10.493 318	11 39 45
2	0 16 34.167	0 30 14.07	7.11	.84	491 125	11 36 17
3	0 17 01.518	0 27 20.06	7.11	.84	488 685	11 32 48
4	0 17 28.833	0 24 26.49	7.11	.84	485 998	11 29 19
5	0 17 56.107	0 21 33.42	7.11	.84	483 064	11 25 51
6	0 18 23.337	- 0 18 40.85	7.12	0.84	10.479 883	11 22 22
7	0 18 50.518	0 15 48.83	7.12	.84	476 456	11 18 53
8	0 19 17.646	0 12 57.37	7.12	.84	472 785	11 15 24
9	0 19 44.719	0 10 06.50	7.12	.84	468 869	11 11 55
10	0 20 11.733	0 07 16.24	7.13	.84	464 711	11 08 26
11	0 20 38.684	- 0 04 26.62	7.13	0.84	10.460 310	11 04 57
12	0 21 05.570	- 0 01 37.65	7.13	.84	455 668	11 01 27
13	0 21 32.385	+ 0 01 10.63	7.14	.84	450 786	10 57 58
14	0 21 59.127	0 03 58.21	7.14	.84	445 666	10 54 29
15	0 22 25.790	0 06 45.04	7.14	.84	440 309	10 50 59
16	0 22 52.371	+ 0 09 31.11	7.15	0.84	10.434 717	10 47 30
17	0 23 18.862	0 12 16.38	7.15	.84	428 891	10 44 00
18	0 23 45.261	0 15 00.81	7.15	.84	422 833	10 40 31
19	0 24 11.562	0 17 44.38	7.16	.84	416 545	10 37 01
20	0 24 37.759	0 20 27.05	7.16	.85	410 028	10 33 31
21	0 25 03.850	+ 0 23 08.80	7.17	0.85	10.403 285	10 30 01
22	0 25 29.832	0 25 49.60	7.17	.85	396 316	10 26 31
23	0 25 55.701	0 28 29.44	7.18	.85	389 125	10 23 01
24	0 26 21.458	0 31 08.33	7.18	.85	381 712	10 19 30
25	0 26 47.101	0 33 46.25	7.19	.85	374 078	10 16 00
26	0 27 12.629	+ 0 36 23.18	7.19	0.85	10.366 227	10 12 29
27	0 27 38.035	0 38 59.11	7.20	.85	358 158	10 08 59
28	0 28 03.317	0 41 34.01	7.20	.85	349 874	10 05 28
29	0 28 28.468	0 44 07.84	7.21	.85	341 375	10 01 57
30	0 28 53.482	0 46 40.57	7.22	.85	332 664	9 58 26
May 1	0 29 18.355	+ 0 49 12.16	7.22	0.85	10.323 741	9 54 55
2	0 29 43.084	0 51 42.59	7.23	.85	314 608	9 51 23
3	0 30 07.662	0 54 11.84	7.24	.85	305 268	9 47 52
4	0 30 32.087	0 56 39.86	7.24	.85	295 722	9 44 20
5	0 30 56.355	0 59 06.65	7.25	.86	285 971	9 40 48
6	0 31 20.463	+ 1 01 32.18	7.26	0.86	10.276 019	9 37 16
7	0 31 44.409	1 03 56.44	7.26	.86	265 867	9 33 44
8	0 32 08.188	1 06 19.40	7.27	.86	255 517	9 30 12
9	0 32 31.797	1 08 41.04	7.28	.86	244 972	9 26 39
10	0 32 55.233	1 11 01.33	7.29	.86	234 234	9 23 06
11	0 33 18.492	+ 1 13 20.27	7.29	0.86	10.223 306	9 19 34
12	0 33 41.569	1 15 37.82	7.30	.86	212 190	9 16 01
13	0 34 04.461	1 17 53.95	7.31	.86	200 889	9 12 27
14	0 34 27.162	1 20 08.64	7.32	.86	189 406	9 08 54
15	0 34 49.666	1 22 21.85	7.33	.86	177 743	9 05 20
16	0 35 11.970	+ 1 24 33.56	7.34	0.87	10.165 904	9 01 47
17	0 35 34.069	1 26 43.73	7.34	0.87	10.153 892	8 58 13

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	0 35 34.069 +21.889	+ 1 26 43.73 +128.62	7.34	0.87	10.153 892 -12 183	8 58 13
18	0 35 55.958 21.678	1 28 52.35 127.04	7.35	.87	.141 709 12 351	8 54 38
19	0 36 17.636 21.464	1 30 59.39 125.45	7.36	.87	.129 358 12 515	8 51 04
20	0 36 39.100 21.248	1 33 04.84 123.85	7.37	.87	.116 843 12 678	8 47 29
21	0 37 00.348 21.032	1 35 08.69 122.27	7.38	.87	.104 165 12 836	8 43 54
22	0 37 21.380 +20.813	+ 1 37 10.96 +120.65	7.39	0.87	10.091 329 -12 993	8 40 19
23	0 37 42.193 20.592	1 39 11.61 119.03	7.40	.87	.078 336 13 146	8 36 44
24	0 38 02.785 20.367	1 41 10.64 117.39	7.41	.87	.065 190 13 298	8 33 09
25	0 38 23.152 20.137	1 43 08.03 115.72	7.42	.88	.051 892 13 447	8 29 33
26	0 38 43.289 19.901	1 45 03.75 114.02	7.43	.88	.038 445 13 592	8 25 57
27	0 39 03.190 +19.659	+ 1 46 57.77 +112.30	7.44	0.88	10.024 853 -13 736	8 22 21
28	0 39 22.849 19.415	1 48 50.07 110.54	7.45	.88	10.011 117 13 878	8 18 44
29	0 39 42.264 19.165	1 50 40.61 108.74	7.46	.88	.997 239 14 015	8 15 08
30	0 40 01.429 18.912	1 52 29.35 106.95	7.47	.88	.983 224 14 150	8 11 31
31	0 40 20.341 18.657	1 54 16.30 105.13	7.48	.88	.969 074 14 283	8 07 53
June 1	0 40 38.998 +18.398	+ 1 56 01.43 +103.28	7.49	0.88	9.954 791 -14 412	8 04 16
2	0 40 57.396 18.136	1 57 44.71 101.43	7.50	.89	.940 379 14 537	8 00 38
3	0 41 15.532 17.871	1 59 26.14 99.56	7.51	.89	.925 842 14 660	7 57 00
4	0 41 33.403 17.604	2 01 05.70 97.67	7.52	.89	.911 182 14 780	7 53 22
5	0 41 51.007 17.334	2 02 43.37 95.76	7.54	.89	.896 402 14 895	7 49 44
6	0 42 08.341 +17.059	+ 2 04 19.13 +93.84	7.55	0.89	9.881 507 -15 008	7 46 05
7	0 42 25.400 16.782	2 05 52.97 91.91	7.56	.89	.866 499 15 116	7 42 26
8	0 42 42.182 16.499	2 07 24.88 89.93	7.57	.89	.851 383 15 222	7 38 47
9	0 42 58.681 16.214	2 08 54.81 87.94	7.58	.89	.836 161 15 322	7 35 07
10	0 43 14.895 15.921	2 10 22.75 85.93	7.59	.90	.820 839 15 420	7 31 27
11	0 43 30.816 +15.626	+ 2 11 48.68 +83.90	7.60	0.90	9.805 419 -15 513	7 27 47
12	0 43 46.442 15.327	2 13 12.58 81.82	7.62	.90	.789 906 15 602	7 24 06
13	0 44 01.769 15.023	2 14 34.40 79.74	7.63	.90	.774 304 15 688	7 20 26
14	0 44 16.792 14.717	2 15 54.14 77.65	7.64	.90	.758 616 15 770	7 16 45
15	0 44 31.509 14.410	2 17 11.79 75.53	7.65	.90	.742 846 15 847	7 13 03
16	0 44 45.919 +14.102	+ 2 18 27.32 +73.43	7.67	0.90	9.726 999 -15 920	7 09 22
17	0 45 00.021 13.793	2 19 40.75 71.32	7.68	.91	.711 079 15 991	7 05 40
18	0 45 13.814 13.482	2 20 52.07 69.21	7.69	.91	.695 088 16 057	7 01 57
19	0 45 27.296 13.171	2 22 01.28 67.09	7.70	.91	.679 031 16 119	6 58 15
20	0 45 40.467 12.856	2 23 08.37 64.98	7.72	.91	.662 912 16 178	6 54 32
21	0 45 53.323 +12.537	+ 2 24 13.35 +62.83	7.73	0.91	9.646 734 -16 234	6 50 49
22	0 46 05.860 12.214	2 25 16.18 60.67	7.74	.91	.630 500 16 286	6 47 05
23	0 46 18.074 11.886	2 26 16.85 58.48	7.76	.92	.614 214 16 334	6 43 21
24	0 46 29.960 11.556	2 27 15.33 56.27	7.77	.92	.597 880 16 379	6 39 37
25	0 46 41.516 11.220	2 28 11.60 54.04	7.78	.92	.581 501 16 420	6 35 53
26	0 46 52.736 +10.883	+ 2 29 05.64 +51.79	7.80	0.92	9.565 081 -16 458	6 32 08
27	0 47 03.619 10.543	2 29 57.43 49.54	7.81	.92	.548 623 16 491	6 28 23
28	0 47 14.162 10.201	2 30 46.97 47.27	7.82	.92	.532 132 16 522	6 24 37
29	0 47 24.363 9.858	2 31 34.24 45.00	7.84	.92	.515 610 16 546	6 20 51
30	0 47 34.221 9.512	2 32 19.24 42.72	7.85	.93	.499 064 16 569	6 17 05
July 1	0 47 43.733 +9.165	+ 2 33 01.96 +40.42	7.86	0.93	9.482 495 -16 585	6 13 18
2	0 47 52.898	+ 2 33 42.38	7.88	0.93	9.465 910	6 09 32

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Date	Apparent Right Ascension		Apparent Declination		Polar S.D.	Hor. Par.	True Distance from the Earth		Ephem- eris Transit	
	^h ^m ^s	^s	[°] ['] ["]	["]	["]	["]	[°] ['] ["]	["]	^h ^m ^s	
July	1	0 47 43.733	+ 9.165	+ 2 33 01.96	+ 40.42	7.86	0.93	9.482 495	-16 585	6 13 18
	2	0 47 52.898	8.817	2 33 42.38	38.13	7.88	.93	.465 910	16 599	6 09 32
	3	0 48 01.715	8.464	2 34 20.51	35.82	7.89	.93	.449 311	16 608	6 05 44
	4	0 48 10.179	8.111	2 34 56.33	33.52	7.91	.93	.432 703	16 612	6 01 57
	5	0 48 18.290	7.754	2 35 29.85	31.18	7.92	.93	.416 091	16 611	5 58 09
	6	0 48 26.044	+ 7.394	+ 2 36 01.03	+ 28.85	7.93	0.94	9.399 480	-16 607	5 54 21
	7	0 48 33.438	7.032	2 36 29.88	26.50	7.95	.94	.382 873	16 598	5 50 32
	8	0 48 40.470	6.665	2 36 56.38	24.12	7.96	.94	.366 275	16 583	5 46 43
	9	0 48 47.135	6.296	2 37 20.50	21.74	7.98	.94	.349 692	16 565	5 42 53
	10	0 48 53.431	5.925	2 37 42.24	19.34	7.99	.94	.333 127	16 541	5 39 04
	11	0 48 59.356	+ 5.553	+ 2 38 01.58	+ 16.95	8.00	0.94	9.316 586	-16 513	5 35 14
	12	0 49 04.909	5.181	2 38 18.53	14.55	8.02	.95	.300 073	16 479	5 31 23
	13	0 49 10.090	4.809	2 38 33.08	12.17	8.03	.95	.283 594	16 443	5 27 32
	14	0 49 14.899	4.438	2 38 45.25	9.79	8.05	.95	.267 151	16 400	5 23 41
	15	0 49 19.337	4.069	2 38 55.04	7.43	8.06	.95	.250 751	16 354	5 19 50
	16	0 49 23.406	+ 3.699	+ 2 39 02.47	+ 5.09	8.08	0.95	9.234 397	-16 303	5 15 58
	17	0 49 27.105	3.328	2 39 07.56	2.73	8.09	.95	.218 094	16 248	5 12 05
	18	0 49 30.433	2.957	2 39 10.29	+ 0.39	8.10	.96	.201 846	16 190	5 08 13
	19	0 49 33.390	2.583	2 39 10.68	- 1.97	8.12	.96	.185 656	16 126	5 04 20
	20	0 49 35.973	2.208	2 39 08.71	4.32	8.13	.96	.169 530	16 058	5 00 26
	21	0 49 38.181	+ 1.829	+ 2 39 04.39	- 6.69	8.15	0.96	9.153 472	-15 987	4 56 32
	22	0 49 40.010	1.450	2 38 57.70	9.07	8.16	.96	.137 485	15 912	4 52 38
	23	0 49 41.460	1.071	2 38 48.63	11.45	8.18	.96	.121 573	15 832	4 48 44
	24	0 49 42.531	0.690	2 38 37.18	13.81	8.19	.97	.105 741	15 748	4 44 49
	25	0 49 43.221	+ 0.311	2 38 23.37	16.18	8.20	.97	.089 993	15 660	4 40 53
	26	0 49 43.532	- 0.068	+ 2 38 07.19	- 18.55	8.22	0.97	9.074 333	-15 566	4 36 58
	27	0 49 43.464	0.447	2 37 48.64	20.89	8.23	.97	.058 767	15 470	4 33 02
	28	0 49 43.017	0.823	2 37 27.75	23.23	8.25	.97	.043 297	15 367	4 29 05
	29	0 49 42.194	1.200	2 37 04.52	25.55	8.26	.97	.027 930	15 262	4 25 08
	30	0 49 40.994	1.576	2 36 38.97	27.87	8.27	.98	9.012 668	15 150	4 21 11
	31	0 49 39.418	+ 1.952	+ 2 36 11.10	- 30.18	8.29	0.98	8.997 518	-15 034	4 17 14
Aug.	1	0 49 37.466	2.326	2 35 40.92	32.48	8.30	.98	.982 484	14 914	4 13 16
	2	0 49 35.140	2.702	2 35 08.44	34.76	8.32	.98	.967 570	14 789	4 09 18
	3	0 49 32.438	3.076	2 34 33.68	37.05	8.33	.98	.952 781	14 659	4 05 19
	4	0 49 29.362	3.452	2 33 56.63	39.34	8.34	.98	.938 122	14 523	4 01 20
	5	0 49 25.910	- 3.827	+ 2 33 17.29	- 41.60	8.36	0.99	8.923 599	-14 384	3 57 20
	6	0 49 22.083	4.201	2 32 35.69	43.87	8.37	.99	.909 215	14 240	3 53 21
	7	0 49 17.882	4.575	2 31 51.82	46.12	8.38	.99	.894 975	14 089	3 49 20
	8	0 49 13.307	4.943	2 31 05.70	48.35	8.40	.99	.880 886	13 936	3 45 20
	9	0 49 08.364	5.308	2 30 17.35	50.55	8.41	.99	.866 950	13 777	3 41 19
	10	0 49 03.056	- 5.669	+ 2 29 26.80	- 52.70	8.42	0.99	8.853 173	-13 614	3 37 18
	11	0 48 57.387	6.026	2 28 34.10	54.83	8.44	1.00	.839 559	13 446	3 33 16
	12	0 48 51.361	6.376	2 27 39.27	56.91	8.45	.00	.826 113	13 274	3 29 14
	13	0 48 44.985	6.726	2 26 42.36	58.98	8.46	.00	.812 839	13 099	3 25 12
	14	0 48 38.259	7.071	2 25 43.38	61.01	8.47	.00	.799 740	12 919	3 21 09
	15	0 48 31.188	- 7.416	+ 2 24 42.37	- 63.01	8.49	1.00	8.786 821	-12 736	3 17 06
	16	0 48 23.772		+ 2 23 39.36		8.50	1.00	8.774 085		3 13 03

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Aug. 16	0 48 23.772 - 7.759	+ 2 23 39.36 - 65.02	8.50	1.00	8.774 085 -12 548	3 13 03
17	0 48 16.013 8.099	2 22 34.34 67.00	8.51	.00	.761 537 12 357	3 08 59
18	0 48 07.914 8.436	2 21 27.34 68.95	8.52	.01	.749 180 12 162	3 04 55
19	0 47 59.478 8.771	2 20 18.39 70.89	8.53	.01	.737 018 11 963	3 00 51
20	0 47 50.707 9.102	2 19 07.50 72.80	8.55	.01	.725 055 11 761	2 56 46
21	0 47 41.605 - 9.428	+ 2 17 54.70 - 74.67	8.56	1.01	8.713 294 -11 555	2 52 41
22	0 47 32.177 9.750	2 16 40.03 76.52	8.57	.01	.701 739 11 345	2 48 36
23	0 47 22.427 10.065	2 15 23.51 78.32	8.58	.01	.690 394 11 131	2 44 30
24	0 47 12.362 10.378	2 14 05.19 80.09	8.59	.01	.679 263 10 914	2 40 24
25	0 47 01.984 10.683	2 12 45.10 81.82	8.60	.02	.668 349 10 692	2 36 18
26	0 46 51.301 -10.984	+ 2 11 23.28 - 83.52	8.61	1.02	8.657 657 -10 466	2 32 12
27	0 46 40.317 11.281	2 09 59.76 85.17	8.62	.02	.647 191 10 237	2 28 05
28	0 46 29.036 11.572	2 08 34.59 86.79	8.63	.02	.636 954 10 005	2 23 58
29	0 46 17.464 11.859	2 07 07.80 88.37	8.64	.02	.626 949 9 767	2 19 50
30	0 46 05.605 12.140	2 05 39.43 89.92	8.65	.02	.617 182 9 527	2 15 42
31	0 45 53.465 -12.418	+ 2 04 09.51 - 91.43	8.66	1.02	8.607 655 -9 283	2 11 34
Sept. 1	0 45 41.047 12.692	2 02 38.08 92.92	8.67	.02	.598 372 9 034	2 07 26
2	0 45 28.355 12.959	2 01 05.16 94.35	8.68	.02	.589 338 8 782	2 03 18
3	0 45 15.396 13.221	1 59 30.81 95.75	8.69	.03	.580 556 8 528	1 59 09
4	0 45 02.175 13.476	1 57 55.06 97.12	8.70	.03	.572 028 8 268	1 55 00
5	0 44 48.699 -13.722	+ 1 56 17.94 - 98.41	8.71	1.03	8.563 760 -8 005	1 50 50
6	0 44 34.977 13.959	1 54 39.53 99.64	8.72	.03	.555 755 7 741	1 46 41
7	0 44 21.018 14.187	1 52 59.89 100.81	8.72	.03	.548 014 7 472	1 42 31
8	0 44 06.831 14.404	1 51 19.08 101.92	8.73	.03	.540 542 7 201	1 38 21
9	0 43 52.427 14.615	1 49 37.16 102.95	8.74	.03	.533 341 6 928	1 34 11
10	0 43 37.812 -14.819	+ 1 47 54.21 -103.95	8.75	1.03	8.526 413 -6 652	1 30 00
11	0 43 22.993 15.015	1 46 10.26 104.88	8.75	.03	.519 761 6 375	1 25 50
12	0 43 07.978 15.207	1 44 25.38 105.79	8.76	.03	.513 386 6 094	1 21 39
13	0 42 52.771 15.390	1 42 39.59 106.64	8.77	.03	.507 292 5 812	1 17 28
14	0 42 37.381 15.568	1 40 52.95 107.45	8.77	.04	.501 480 5 528	1 13 16
15	0 42 21.813 -15.737	+ 1 39 05.50 -108.21	8.78	1.04	8.495 952 -5 242	1 09 05
16	0 42 06.076 15.899	1 37 17.29 108.92	8.78	.04	.490 710 4 955	1 04 54
17	0 41 50.177 16.053	1 35 28.37 109.58	8.79	.04	.485 755 4 666	1 00 42
18	0 41 34.124 16.197	1 33 38.79 110.17	8.79	.04	.481 089 4 374	0 56 30
19	0 41 17.927 16.333	1 31 48.62 110.70	8.80	.04	.476 715 4 082	0 52 18
20	0 41 01.594 -16.459	+ 1 29 57.92 -111.18	8.80	1.04	8.472 633 -3 787	0 48 06
21	0 40 45.135 16.576	1 28 06.74 111.60	8.81	.04	.468 846 3 491	0 43 53
22	0 40 28.559 16.684	1 26 15.14 111.94	8.81	.04	.465 355 3 194	0 39 41
23	0 40 11.875 16.784	1 24 23.20 112.25	8.81	.04	.462 161 2 894	0 35 29
24	0 39 55.091 16.875	1 22 30.95 112.48	8.82	.04	.459 267 2 594	0 31 16
25	0 39 38.216 -16.957	+ 1 20 38.47 -112.65	8.82	1.04	8.456 673 -2 291	0 27 03
26	0 39 21.259 17.032	1 18 45.82 112.79	8.82	.04	.454 382 1 989	0 22 51
27	0 39 04.227 17.098	1 16 53.03 112.85	8.82	.04	.452 393 1 684	0 18 38
28	0 38 47.129 17.157	1 15 00.18 112.87	8.82	.04	.450 709 1 378	0 14 25
29	0 38 29.972 17.206	1 13 07.31 112.84	8.83	.04	.449 331 1 071	0 10 12
30	0 38 12.766 -17.248	+ 1 11 14.47 -112.75	8.83	1.04	8.448 260 -764	0 05 59
Oct. 1	0 37 55.518	+ 1 09 21.72	8.83	1.04	8.447 496	{ 0 01 46 } { 23 57 33 }

SATURN, 1967

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
Oct. 1	^{h m s} 0 37 55.518 ^s -17.280	^{° ′ ″} + 1 09 21.72 [″] -112.59	8.83	1.04	8.447 496 - 455	^{h m s} { 23 57 33 } 23 53 20
2	0 37 38.238 17.301	1 07 29.13 112.39	8.83	.04	.447 041 - 146	23 49 06
3	0 37 20.937 17.310	1 05 36.74 112.08	8.83	.04	.446 895 + 163	23 44 53
4	0 37 03.627 17.307	1 03 44.66 111.71	8.83	.04	.447 058 473	23 40 40
5	0 36 46.320 17.293	1 01 52.95 111.25	8.83	.04	.447 531 783	23 36 27
6	0 36 29.027 -17.268	+ 1 00 01.70 -110.74	8.83	1.04	8.448 314 + 1 092	23 32 14
7	0 36 11.759 17.232	0 58 10.96 110.13	8.83	.04	.449 406 1 401	23 28 01
8	0 35 54.527 17.189	0 56 20.83 109.50	8.82	.04	.450 807 1 708	23 23 48
9	0 35 37.338 17.137	0 54 31.33 108.79	8.82	.04	.452 515 2 016	23 19 35
10	0 35 20.201 17.078	0 52 42.54 108.05	8.82	.04	.454 531 2 321	23 15 22
11	0 35 03.123 -17.012	+ 0 50 54.49 -107.25	8.82	1.04	8.456 852 + 2 626	23 11 10
12	0 34 46.111 16.935	0 49 07.24 106.40	8.81	.04	.459 478 2 930	23 06 57
13	0 34 29.176 16.850	0 47 20.84 105.50	8.81	.04	.462 408 3 232	23 02 44
14	0 34 12.326 16.756	0 45 35.34 104.54	8.81	.04	.465 640 3 533	22 58 32
15	0 33 55.570 16.652	0 43 50.80 103.52	8.80	.04	.469 173 3 832	22 54 20
16	0 33 38.918 -16.539	+ 0 42 07.28 -102.44	8.80	1.04	8.473 005 + 4 131	22 50 07
17	0 33 22.379 16.415	0 40 24.84 101.30	8.80	.04	.477 136 4 428	22 45 55
18	0 33 05.964 16.283	0 38 43.54 100.11	8.79	.04	.481 564 4 724	22 41 43
19	0 32 49.681 16.140	0 37 03.43 98.85	8.79	.04	.486 288 5 017	22 37 31
20	0 32 33.541 15.991	0 35 24.58 97.55	8.78	.04	.491 305 5 309	22 33 20
21	0 32 17.550 -15.831	+ 0 33 47.03 -96.19	8.78	1.04	8.496 614 + 5 599	22 29 08
22	0 32 01.719 15.665	0 32 10.84 94.77	8.77	.04	.502 213 5 889	22 24 57
23	0 31 46.054 15.489	0 30 36.07 93.33	8.76	.03	.508 102 6 175	22 20 46
24	0 31 30.565 15.308	0 29 02.74 91.82	8.76	.03	.514 277 6 460	22 16 35
25	0 31 15.257 15.118	0 27 30.92 90.29	8.75	.03	.520 737 6 743	22 12 24
26	0 31 00.139 -14.921	+ 0 26 00.63 -88.70	8.74	1.03	8.527 480 + 7 025	22 08 14
27	0 30 45.218 14.718	0 24 31.93 87.06	8.74	.03	.534 505 7 303	22 04 03
28	0 30 30.500 14.506	0 23 04.87 85.40	8.73	.03	.541 808 7 579	21 59 53
29	0 30 15.994 14.285	0 21 39.47 83.66	8.72	.03	.549 387 7 853	21 55 43
30	0 30 01.709 14.056	0 20 15.81 81.89	8.71	.03	.557 240 8 125	21 51 34
Nov. 1	0 29 47.653 -13.816	+ 0 18 53.92 -80.05	8.71	1.03	8.565 365 + 8 393	21 47 24
2	0 29 33.837 13.567	0 17 33.87 78.14	8.70	.03	.573 758 8 659	21 43 15
3	0 29 20.270 13.306	0 16 15.73 76.18	8.69	.03	.582 417 8 920	21 39 06
4	0 29 06.964 13.040	0 14 59.55 74.18	8.68	.02	.591 337 9 180	21 34 57
5	0 28 53.924 12.766	0 13 45.37 72.12	8.67	.02	.600 517 9 434	21 30 49
6	0 28 41.158 -12.488	+ 0 12 33.25 -70.04	8.66	1.02	8.609 951 + 9 686	21 26 41
7	0 28 28.670 12.204	0 11 23.21 67.94	8.65	.02	.619 637 9 932	21 22 33
8	0 28 16.466 11.916	0 10 15.27 65.82	8.64	.02	.629 569 10 176	21 18 26
9	0 28 04.550 11.624	0 09 09.45 63.66	8.63	.02	.639 745 10 415	21 14 18
10	0 27 52.926 11.324	0 08 05.79 61.48	8.62	.02	.650 160 10 650	21 10 12
11	0 27 41.602 -11.019	+ 0 07 04.31 -59.26	8.61	1.02	8.660 810 + 10 881	21 06 05
12	0 27 30.583 10.708	0 06 05.05 57.01	8.60	.01	.671 691 11 108	21 01 59
13	0 27 19.875 10.391	0 05 08.04 54.74	8.59	.01	.682 799 11 331	20 57 53
14	0 27 09.484 10.066	0 04 13.30 52.42	8.58	.01	.694 130 11 550	20 53 47
15	0 26 59.418 9.738	0 03 20.88 50.08	8.57	.01	.705 680 11 765	20 49 42
16	0 26 49.680 -9.404	+ 0 02 30.80 -47.70	8.55	1.01	8.717 445 + 11 976	20 45 37
17	0 26 40.276	+ 0 01 43.10	8.54	1.01	8.729 421	

SATURN, 1967

FOR 0^h EPHEMERIS TIME

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Date	Apparent Right Ascension	Apparent Declination	Polar S.D.	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	[°]	["]		^h ^m ^s
Nov. 16	0 26 40.276 - 9.064	+ 0 01 43.10 - 45.31	8.54	1.01	8.729 421	20 45 37
17	0 26 31.212 8.720	0 00 57.79 42.89	8.53	.01	.741 603 +12 182	20 41 32
18	0 26 22.492 8.373	+ 0 00 14.90 40.46	8.52	.01	.753 988 12 385	20 37 28
19	0 26 14.119 8.021	- 0 00 25.56 37.99	8.51	.00	.766 571 12 583	20 33 24
20	0 26 06.098 7.668	0 01 03.55 35.53	8.49	.00	.779 349 12 778	20 29 20
21	0 25 58.430 - 7.309	- 0 01 39.08 - 33.04	8.48	1.00	8.792 317 +13 154	20 25 17
22	0 25 51.121 6.950	0 02 12.12 30.54	8.47	.00	.805 471 13 336	20 21 14
23	0 25 44.171 6.587	0 02 42.66 28.05	8.46	.00	.818 807 13 514	20 17 12
24	0 25 37.584 6.221	0 03 10.71 25.52	8.44	1.00	.832 321 13 686	20 13 10
25	0 25 31.363 5.852	0 03 36.23 22.99	8.43	0.99	.846 007 13 855	20 09 08
26	0 25 25.511 - 5.477	- 0 03 59.22 - 20.43	8.42	0.99	8.859 862 +14 020	20 05 06
27	0 25 20.034 5.099	0 04 19.65 17.85	8.40	.99	.873 882 14 178	20 01 05
28	0 25 14.935 4.713	0 04 37.50 15.24	8.39	.99	.888 060 14 334	19 57 05
29	0 25 10.222 4.326	0 04 52.74 12.60	8.38	.99	.902 394 14 484	19 53 04
30	0 25 05.896 3.933	0 05 05.34 9.95	8.36	.99	.916 878 14 628	19 49 05
Dec. 1	0 25 01.963 - 3.538	- 0 05 15.29 - 7.28	8.35	0.99	8.931 506 +14 767	19 45 05
2	0 24 58.425 3.142	0 05 22.57 4.62	8.34	.98	.946 273 14 901	19 41 06
3	0 24 55.283 2.747	0 05 27.19 - 1.96	8.32	.98	.961 174 15 030	19 37 07
4	0 24 52.536 2.351	0 05 29.15 + 0.69	8.31	.98	.976 204 15 153	19 33 09
5	0 24 50.185 1.958	0 05 28.46 3.34	8.29	.98	8.991 357 15 271	19 29 11
6	0 24 48.227 - 1.561	- 0 05 25.12 + 5.96	8.28	0.98	9.006 628 +15 383	19 25 13
7	0 24 46.666 1.165	0 05 19.16 8.60	8.27	.98	.022 011 15 490	19 21 16
8	0 24 45.501 0.767	0 05 10.56 11.24	8.25	.97	.037 501 15 592	19 17 20
9	0 24 44.734 - 0.368	0 04 59.32 13.87	8.24	.97	.053 093 15 688	19 13 23
10	0 24 44.366 + 0.034	0 04 45.45 16.52	8.22	.97	.068 781 15 780	19 09 27
11	0 24 44.400 + 0.434	- 0 04 28.93 + 19.15	8.21	0.97	9.084 561 +15 866	19 05 32
12	0 24 44.834 0.837	0 04 09.78 21.78	8.19	.97	.100 427 15 948	19 01 36
13	0 24 45.671 1.240	0 03 48.00 24.42	8.18	.97	.116 375 16 024	18 57 42
14	0 24 46.911 1.642	0 03 23.58 27.04	8.17	.96	.132 399 16 096	18 53 47
15	0 24 48.553 2.045	0 02 56.54 29.66	8.15	.96	.148 495 16 163	18 49 53
16	0 24 50.598 + 2.445	- 0 02 26.88 + 32.26	8.14	0.96	9.164 658 +16 224	18 46 00
17	0 24 53.043 2.844	0 01 54.62 34.86	8.12	.96	.180 882 16 282	18 42 07
18	0 24 55.887 3.243	0 01 19.76 37.42	8.11	.96	.197 164 16 333	18 38 14
19	0 24 59.130 3.639	0 00 42.34 39.98	8.09	.96	.213 497 16 381	18 34 21
20	0 25 02.769 4.032	- 0 00 02.36 42.52	8.08	.95	.229 878 16 425	18 30 29
21	0 25 06.801 + 4.427	+ 0 00 40.16 + 45.03	8.06	0.95	9.246 303 +16 462	18 26 38
22	0 25 11.228 4.818	0 01 25.19 47.56	8.05	.95	.262 765 16 495	18 22 47
23	0 25 16.046 5.212	0 02 12.75 50.05	8.04	.95	.279 260 16 524	18 18 56
24	0 25 21.258 5.603	0 03 02.80 52.57	8.02	.95	.295 784 16 548	18 15 05
25	0 25 26.861 5.998	0 03 55.37 55.07	8.01	.94	.312 332 16 567	18 11 15
26	0 25 32.859 + 6.391	+ 0 04 50.44 + 57.57	7.99	0.94	9.328 899 +16 580	18 07 26
27	0 25 39.250 6.786	0 05 48.01 60.06	7.98	.94	.345 479 16 588	18 03 36
28	0 25 46.036 7.178	0 06 48.07 62.55	7.97	.94	.362 067 16 592	17 59 48
29	0 25 53.214 7.569	0 07 50.62 65.03	7.95	.94	.378 659 16 590	17 55 59
30	0 26 00.783 7.956	0 08 55.65 67.47	7.94	.94	.395 249 16 583	17 52 11
31	0 26 08.739 + 8.339	+ 0 10 03.12 + 69.88	7.92	0.93	9.411 832 +16 570	17 48 23
32	0 26 17.078	+ 0 11 13.00	7.91	0.93	9.428 402	17 44 36

URANUS, 1967
FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	^h	^m	^s	[°]	[']	["]	["]	["]				^h ^m ^s
Jan.	0	11	40 45.907	-	0.184	+ 2 55 43.33	+ 3.93	1.90	0.49	18.01593	-1667	5 04 03
	1	11	40 45.723	-	0.395	2 55 47.26	5.28	.90	.49	17.99926	1659	5 00 07
	2	11	40 45.328	-	0.604	2 55 52.54	6.63	.91	.49	.98267	1650	4 56 10
	3	11	40 44.724	-	0.812	2 55 59.17	7.95	.91	.49	.96617	1642	4 52 14
	4	11	40 43.912	-	1.017	2 56 07.12	9.27	.91	.49	.94975	1632	4 48 17
	5	11	40 42.895	-	1.222	+ 2 56 16.39	+10.57	1.91	0.49	17.93343	-1622	4 44 20
	6	11	40 41.673	-	1.424	2 56 26.96	11.87	.91	.49	.91721	1612	4 40 23
	7	11	40 40.249	-	1.626	2 56 38.83	13.17	.91	.49	.90109	1600	4 36 26
	8	11	40 38.623	-	1.829	2 56 52.00	14.47	.92	.49	.88509	1589	4 32 28
	9	11	40 36.794	-	2.033	2 57 06.47	15.77	.92	.49	.86920	1576	4 28 30
	10	11	40 34.761	-	2.235	+ 2 57 22.24	+17.06	1.92	0.49	17.85344	-1564	4 24 32
	11	11	40 32.526	-	2.439	2 57 39.30	18.37	.92	.49	.83780	1550	4 20 34
	12	11	40 30.087	-	2.642	2 57 57.67	19.67	.92	.49	.82230	1537	4 16 36
	13	11	40 27.445	-	2.842	2 58 17.34	20.94	.93	.49	.80693	1522	4 12 37
	14	11	40 24.603	-	3.041	2 58 38.28	22.21	.93	.49	.79171	1507	4 08 38
	15	11	40 21.562	-	3.238	+ 2 59 00.49	+23.45	1.93	0.50	17.77664	-1492	4 04 39
	16	11	40 18.324	-	3.433	2 59 23.94	24.70	.93	.50	.76172	1476	4 00 40
	17	11	40 14.891	-	3.623	2 59 48.64	25.90	.93	.50	.74696	1459	3 56 41
	18	11	40 11.268	-	3.813	3 00 14.54	27.09	.93	.50	.73237	1443	3 52 41
	19	11	40 07.455	-	3.997	3 00 41.63	28.27	.93	.50	.71794	1426	3 48 42
	20	11	40 03.458	-	4.182	+ 3 01 09.90	+29.42	1.94	0.50	17.70368	-1407	3 44 42
	21	11	39 59.276	-	4.361	3 01 39.32	30.56	.94	.50	.68961	1390	3 40 41
	22	11	39 54.915	-	4.541	3 02 09.88	31.70	.94	.50	.67571	1371	3 36 41
	23	11	39 50.374	-	4.718	3 02 41.58	32.80	.94	.50	.66200	1352	3 32 41
	24	11	39 45.656	-	4.894	3 03 14.38	33.91	.94	.50	.64848	1332	3 28 40
	25	11	39 40.762	-	5.071	+ 3 03 48.29	+35.02	1.94	0.50	17.63516	-1313	3 24 39
	26	11	39 35.691	-	5.245	3 04 23.31	36.12	.95	.50	.62203	1292	3 20 38
	27	11	39 30.446	-	5.419	3 04 59.43	37.21	.95	.50	.60911	1272	3 16 37
	28	11	39 25.027	-	5.591	3 05 36.64	38.28	.95	.50	.59639	1251	3 12 36
	29	11	39 19.436	-	5.760	3 06 14.92	39.32	.95	.50	.58388	1229	3 08 34
	30	11	39 13.676	-	5.924	+ 3 06 54.24	+40.35	1.95	0.50	17.57159	-1208	3 04 33
Feb.	1	11	39 07.752	-	6.084	3 07 34.59	41.34	.95	.50	.55951	1185	3 00 31
	2	11	39 01.668	-	6.240	3 08 15.93	42.30	.95	.50	.54766	1163	2 56 29
	3	11	38 55.428	-	6.394	3 08 58.23	43.26	.95	.50	.53603	1139	2 52 27
	4	11	38 49.034	-	6.544	3 09 41.49	44.18	.96	.50	.52464	1116	2 48 24
	5	11	38 42.490	-	6.692	+ 3 10 25.67	+45.11	1.96	0.50	17.51348	-1093	2 44 22
	6	11	38 35.798	-	6.839	3 11 10.78	46.01	.96	.50	.50255	1067	2 40 20
	7	11	38 28.959	-	6.985	3 11 56.79	46.91	.96	.50	.49188	1044	2 36 17
	8	11	38 21.974	-	7.126	3 12 43.70	47.79	.96	.50	.48144	1018	2 32 14
	9	11	38 14.848	-	7.268	3 13 31.49	48.64	.96	.50	.47126	993	2 28 11
	10	11	38 07.580	-	7.403	+ 3 14 20.13	+49.49	1.96	0.50	17.46133	-966	2 24 08
	11	11	38 00.177	-	7.537	3 15 09.62	50.30	.96	.50	.45167	941	2 20 04
	12	11	37 52.640	-	7.666	3 15 59.92	51.08	.97	.50	.44226	915	2 16 01
	13	11	37 44.974	-	7.790	3 16 51.00	51.83	.97	.50	.43311	887	2 11 57
	14	11	37 37.184	-	7.910	3 17 42.83	52.56	.97	.51	.42424	861	2 07 54
	15	11	37 29.274	-	8.025	+ 3 18 35.39	+53.24	1.97	0.51	17.41563	-833	2 03 50
	15	11	37 21.249	-		+ 3 19 28.63		1.97	0.51	17.40730		1 59 46

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	11 37 21.249 - 8.136	+ 3 19 28.63 +53.90	1.97	0.51	17.40730 - 806	1 59 46
16	11 37 13.113 - 8.241	3 20 22.53 54.54	.97	.51	.39924 778	1 55 42
17	11 37 04.872 - 8.343	3 21 17.07 55.13	.97	.51	.39146 750	1 51 38
18	11 36 56.529 - 8.440	3 22 12.20 55.70	.97	.51	.38396 721	1 47 34
19	11 36 48.089 - 8.535	3 23 07.90 56.26	.97	.51	.37675 693	1 43 29
20	11 36 39.554 - 8.625	+ 3 24 04.16 +56.79	1.97	0.51	17.36982 - 665	1 39 25
21	11 36 30.929 - 8.714	3 25 00.95 57.31	.97	.51	.36317 635	1 35 21
22	11 36 22.215 - 8.801	3 25 58.26 57.80	.98	.51	.35682 607	1 31 16
23	11 36 13.414 - 8.884	3 26 56.06 58.29	.98	.51	.35075 578	1 27 11
24	11 36 04.530 - 8.964	3 27 54.35 58.75	.98	.51	.34497 548	1 23 07
25	11 35 55.566 - 9.042	+ 3 28 53.10 +59.18	1.98	0.51	17.33949 - 519	1 19 02
26	11 35 46.524 - 9.112	3 29 52.28 59.57	.98	.51	.33430 489	1 14 57
27	11 35 37.412 - 9.177	3 30 51.85 59.93	.98	.51	.32941 460	1 10 52
28	11 35 28.235 - 9.236	3 31 51.78 60.24	.98	.51	.32481 429	1 06 47
Mar. 1	11 35 18.999 - 9.291	3 32 52.02 60.53	.98	.51	.32052 400	1 02 42
2	11 35 09.708 - 9.341	+ 3 33 52.55 +60.80	1.98	0.51	17.31652 - 369	0 58 37
3	11 35 00.367 - 9.389	3 34 53.35 61.05	.98	.51	.31283 339	0 54 31
4	11 34 50.978 - 9.433	3 35 54.40 61.27	.98	.51	.30944 309	0 50 26
5	11 34 41.545 - 9.474	3 36 55.67 61.48	.98	.51	.30635 278	0 46 21
6	11 34 32.071 - 9.513	3 37 57.15 61.66	.98	.51	.30357 247	0 42 15
7	11 34 22.558 - 9.547	+ 3 38 58.81 +61.84	1.98	0.51	17.30110 - 216	0 38 10
8	11 34 13.011 - 9.577	3 40 00.65 61.96	.98	.51	.29894 186	0 34 05
9	11 34 03.434 - 9.603	3 41 02.61 62.06	.98	.51	.29708 154	0 29 59
10	11 33 53.831 - 9.623	3 42 04.67 62.14	.98	.51	.29554 124	0 25 54
11	11 33 44.208 - 9.639	3 43 06.81 62.17	.98	.51	.29430 92	0 21 48
12	11 33 34.569 - 9.648	+ 3 44 08.98 +62.16	1.98	0.51	17.29338 - 62	0 17 43
13	11 33 24.921 - 9.653	3 45 11.14 62.13	.98	.51	.29276 - 30	0 13 37
14	11 33 15.268 - 9.652	3 46 13.27 62.06	.98	.51	.29246 0	0 09 32
15	11 33 05.616 - 9.646	3 47 15.33 61.95	.98	.51	.29246 + 32	0 05 26
16	11 32 55.970 - 9.635	3 48 17.28 61.82	.98	.51	.29278 62	{ 0 01 21 } { 23 57 15 }
17	11 32 46.335 - 9.620	+ 3 49 19.10 +61.65	1.98	0.51	17.29340 + 93	23 53 10
18	11 32 36.715 - 9.600	3 50 20.75 61.47	.98	.51	.29433 124	23 49 04
19	11 32 27.115 - 9.576	3 51 22.22 61.25	.98	.51	.29557 154	23 44 59
20	11 32 17.539 - 9.551	3 52 23.47 61.02	.98	.51	.29711 185	23 40 54
21	11 32 07.988 - 9.521	3 53 24.49 60.77	.98	.51	.29896 216	23 36 48
22	11 31 58.467 - 9.489	+ 3 54 25.26 +60.51	1.98	0.51	17.30112 + 245	23 32 43
23	11 31 48.978 - 9.454	3 55 25.77 60.21	.98	.51	.30357 276	23 28 38
24	11 31 39.524 - 9.416	3 56 25.98 59.90	.98	.51	.30633 305	23 24 32
25	11 31 30.108 - 9.372	3 57 25.88 59.56	.98	.51	.30938 336	23 20 27
26	11 31 20.736 - 9.323	3 58 25.44 59.17	.98	.51	.31274 365	23 16 22
27	11 31 11.413 - 9.267	+ 3 59 24.61 +58.74	1.98	0.51	17.31639 + 394	23 12 17
28	11 31 02.146 - 9.207	4 00 23.35 58.29	.98	.51	.32033 424	23 08 12
29	11 30 52.939 - 9.142	4 01 21.64 57.82	.98	.51	.32457 454	23 04 07
30	11 30 43.797 - 9.075	4 02 19.46 57.33	.98	.51	.32911 482	23 00 02
31	11 30 34.722 - 9.004	4 03 16.79 56.82	.98	.51	.33393 511	22 55 57
Apr. 1	11 30 25.718 - 8.932	+ 4 04 13.61 +56.30	1.98	0.51	17.33904 + 541	22 51 52
2	11 30 16.786 - 8.832	+ 4 05 09.91 +56.30	1.98	0.51	17.34445 + 541	22 47 47

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FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	11 30 25.718 - 8.932	+ 4 04 13.61 + 56.30	1.98	0.51	17.33904 + 541	22 51 52
2	11 30 16.786 8.857	4 05 09.91 55.76	.98	.51	.34445 568	22 47 47
3	11 30 07.929 8.778	4 06 05.67 55.20	.98	.51	.35013 598	22 43 43
4	11 29 59.151 8.696	4 07 00.87 54.63	.98	.51	.35611 625	22 39 38
5	11 29 50.455 8.610	4 07 55.50 54.01	.97	.51	.36236 654	22 35 34
6	11 29 41.845 - 8.519	+ 4 08 49.51 + 53.38	1.97	0.51	17.36890 + 681	22 31 29
7	11 29 33.326 8.425	4 09 42.89 52.72	.97	.51	.37571 709	22 27 25
8	11 29 24.901 8.325	4 10 35.61 52.02	.97	.51	.38280 737	22 23 21
9	11 29 16.576 8.222	4 11 27.63 51.30	.97	.51	.39017 763	22 19 17
10	11 29 08.354 8.112	4 12 18.93 50.54	.97	.51	.39780 790	22 15 13
11	11 29 00.242 - 8.000	+ 4 13 09.47 + 49.76	1.97	0.51	17.40570 + 816	22 11 09
12	11 28 52.242 7.883	4 13 59.23 48.97	.97	.51	.41386 843	22 07 05
13	11 28 44.359 7.762	4 14 48.20 48.14	.97	.51	.42229 868	22 03 02
14	11 28 36.597 7.639	4 15 36.34 47.29	.97	.50	.43097 894	21 58 58
15	11 28 28.958 7.513	4 16 23.63 46.44	.97	.50	.43991 919	21 54 55
16	11 28 21.445 - 7.384	+ 4 17 10.07 + 45.58	1.96	0.50	17.44910 + 944	21 50 51
17	11 28 14.061 7.254	4 17 55.65 44.68	.96	.50	.45854 968	21 46 48
18	11 28 06.807 7.123	4 18 40.33 43.80	.96	.50	.46822 992	21 42 45
19	11 27 59.684 6.988	4 19 24.13 42.90	.96	.50	.47814 1016	21 38 42
20	11 27 52.696 6.854	4 20 07.03 41.99	.96	.50	.48830 1039	21 34 40
21	11 27 45.842 - 6.714	+ 4 20 49.02 + 41.04	1.96	0.50	17.49869 + 1062	21 30 37
22	11 27 39.128 6.572	4 21 30.06 40.08	.96	.50	.50931 1084	21 26 35
23	11 27 32.556 6.425	4 22 10.14 39.10	.96	.50	.52015 1107	21 22 32
24	11 27 26.131 6.273	4 22 49.24 38.08	.96	.50	.53122 1128	21 18 30
25	11 27 19.858 6.118	4 23 27.32 37.04	.95	.50	.54250 1150	21 14 28
26	11 27 13.740 - 5.962	+ 4 24 04.36 + 36.01	1.95	0.50	17.55400 + 1171	21 10 26
27	11 27 07.778 5.804	4 24 40.37 34.96	.95	.50	.56571 1192	21 06 25
28	11 27 01.974 5.647	4 25 15.33 33.92	.95	.50	.57763 1212	21 02 23
29	11 26 56.327 5.486	4 25 49.25 32.87	.95	.50	.58975 1233	20 58 22
30	11 26 50.841 5.327	4 26 22.12 31.81	.95	.50	.60208 1252	20 54 20
May 1	11 26 45.514 - 5.165	+ 4 26 53.93 + 30.74	1.95	0.50	17.61460 + 1271	20 50 19
2	11 26 40.349 5.001	4 27 24.67 29.67	.94	.50	.62731 1290	20 46 18
3	11 26 35.348 4.833	4 27 54.34 28.56	.94	.50	.64021 1309	20 42 18
4	11 26 30.515 4.665	4 28 22.90 27.44	.94	.50	.65330 1327	20 38 17
5	11 26 25.850 4.491	4 28 50.34 26.32	.94	.50	.66657 1344	20 34 17
6	11 26 21.359 - 4.317	+ 4 29 16.66 + 25.15	1.94	0.50	17.68001 + 1362	20 30 16
7	11 26 17.042 4.138	4 29 41.81 23.98	.94	.50	.69363 1378	20 26 16
8	11 26 12.904 3.957	4 30 05.79 22.81	.94	.50	.70741 1395	20 22 17
9	11 26 08.947 3.774	4 30 28.60 21.60	.93	.50	.72136 1411	20 18 17
10	11 26 05.173 3.590	4 30 50.20 20.39	.93	.50	.73547 1426	20 14 17
11	11 26 01.583 - 3.403	+ 4 31 10.59 + 19.18	1.93	0.50	17.74973 + 1441	20 10 18
12	11 25 58.180 3.215	4 31 29.77 17.96	.93	.50	.76414 1456	20 06 19
13	11 25 54.965 3.029	4 31 47.73 16.75	.93	.49	.77870 1469	20 02 20
14	11 25 51.936 2.842	4 32 04.48 15.52	.93	.49	.79339 1483	19 58 21
15	11 25 49.094 2.654	4 32 20.00 14.31	.92	.49	.80822 1496	19 54 23
16	11 25 46.440 - 2.467	+ 4 32 34.31 + 13.10	1.92	0.49	17.82318 + 1508	19 50 24
17	11 25 43.973	+ 4 32 47.41	1.92	0.49	17.83826	19 46 26

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
May 17	11 25 43.973 - 2.279	+ 4 32 47.41 + 11.87	1.92	0.49	17.83826 +1521	19 46 26
18	11 25 41.694 2.091	4 32 59.28 10.65	.92	.49	.85347 1532	19 42 28
19	11 25 39.603 1.901	4 33 09.93 9.42	.92	.49	.86879 1543	19 38 30
20	11 25 37.702 1.709	4 33 19.35 8.16	.92	.49	.88422 1553	19 34 32
21	11 25 35.993 1.514	4 33 27.51 6.90	.92	.49	.89975 1564	19 30 35
22	11 25 34.479 - 1.317	+ 4 33 34.41 + 5.62	1.91	0.49	17.91539 +1573	19 26 38
23	11 25 33.162 1.120	4 33 40.03 4.35	.91	.49	.93112 1583	19 22 41
24	11 25 32.042 0.923	4 33 44.38 3.09	.91	.49	.94695 1592	19 18 44
25	11 25 31.119 0.727	4 33 47.47 1.82	.91	.49	.96287 1600	19 14 47
26	11 25 30.392 0.532	4 33 49.29 + 0.59	.91	.49	.97887 1608	19 10 51
27	11 25 29.860 - 0.339	+ 4 33 49.88 - 0.67	1.90	0.49	17.99495 +1615	19 06 54
28	11 25 29.521 - 0.146	4 33 49.21 1.90	.90	.49	18.01110 1623	19 02 58
29	11 25 29.375 + 0.048	4 33 47.31 3.14	.90	.49	.02733 1629	18 59 02
30	11 25 29.423 0.241	4 33 44.17 4.38	.90	.49	.04362 1636	18 55 07
31	11 25 29.664 0.437	4 33 39.79 5.64	.90	.49	.05998 1641	18 51 11
June 1	11 25 30.101 + 0.633	+ 4 33 34.15 - 6.90	1.90	0.49	18.07639 +1647	18 47 16
2	11 25 30.734 0.830	4 33 27.25 8.17	.89	.49	.09286 1651	18 43 21
3	11 25 31.564 1.028	4 33 19.08 9.44	.89	.49	.10937 1656	18 39 26
4	11 25 32.592 1.228	4 33 09.64 10.72	.89	.49	.12593 1660	18 35 31
5	11 25 33.820 1.427	4 32 58.92 12.00	.89	.49	.14253 1663	18 31 36
6	11 25 35.247 + 1.628	+ 4 32 46.92 - 13.29	1.89	0.48	18.15916 +1666	18 27 42
7	11 25 36.875 1.828	4 32 33.63 14.56	.89	.48	.17582 1668	18 23 48
8	11 25 38.703 2.027	4 32 19.07 15.83	.88	.48	.19250 1670	18 19 54
9	11 25 40.730 2.224	4 32 03.24 17.09	.88	.48	.20920 1671	18 16 00
10	11 25 42.954 2.422	4 31 46.15 18.34	.88	.48	.22591 1673	18 12 07
11	11 25 45.376 + 2.615	+ 4 31 27.81 - 19.59	1.88	0.48	18.24264 +1672	18 08 13
12	11 25 47.991 2.808	4 31 08.22 20.80	.88	.48	.25936 1673	18 04 20
13	11 25 50.799 2.999	4 30 47.42 22.04	.88	.48	.27609 1672	18 00 27
14	11 25 53.798 3.190	4 30 25.38 23.25	.87	.48	.29281 1671	17 56 34
15	11 25 56.988 3.380	4 30 02.13 24.46	.87	.48	.30952 1669	17 52 42
16	11 26 00.368 + 3.571	+ 4 29 37.67 - 25.69	1.87	0.48	18.32621 +1667	17 48 49
17	11 26 03.939 3.763	4 29 11.98 26.91	.87	.48	.34288 1665	17 44 57
18	11 26 07.702 3.955	4 28 45.07 28.14	.87	.48	.35953 1662	17 41 05
19	11 26 11.657 4.147	4 28 16.93 29.36	.87	.48	.37615 1659	17 37 13
20	11 26 15.804 4.337	4 27 47.57 30.57	.86	.48	.39274 1655	17 33 22
21	11 26 20.141 + 4.526	+ 4 27 17.00 - 31.76	1.86	0.48	18.40929 +1651	17 29 30
22	11 26 24.667 4.712	4 26 45.24 32.93	.86	.48	.42580 1647	17 25 39
23	11 26 29.379 4.895	4 26 12.31 34.10	.86	.48	.44227 1641	17 21 48
24	11 26 34.274 5.075	4 25 38.21 35.23	.86	.48	.45868 1637	17 17 57
25	11 26 39.349 5.255	4 25 02.98 36.36	.86	.48	.47505 1631	17 14 06
26	11 26 44.604 + 5.434	+ 4 24 26.62 - 37.50	1.85	0.48	18.49136 +1624	17 10 16
27	11 26 50.038 5.611	4 23 49.12 38.63	.85	.48	.50760 1618	17 06 25
28	11 26 55.649 5.790	4 23 10.49 39.76	.85	.48	.52378 1611	17 02 35
29	11 27 01.439 5.967	4 22 30.73 40.88	.85	.47	.53989 1604	16 58 45
30	11 27 07.406 6.145	4 21 49.85 42.02	.85	.47	.55593 1596	16 54 55
July 1	11 27 13.551 + 6.322	+ 4 21 07.83 - 43.14	1.85	0.47	18.57189 +1588	16 51 06
2	11 27 19.873	+ 4 20 24.69	1.84	0.47	18.58777	16 47 16

URANUS, 1967 FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
July	^{h m s}	^{° ' "}	["]	["]		^{h m s}
1	11 27 13.551 + 6.322	+ 4 21 07.83 -43.14	1.85	0.47	18.57189 +1588	16 51 06
2	11 27 19.873 6.500	4 20 24.69 44.26	.84	.47	.58777 1579	16 47 16
3	11 27 26.373 6.675	4 19 40.43 45.37	.84	.47	.60356 1570	16 43 27
4	11 27 33.048 6.851	4 18 55.06 46.48	.84	.47	.61926 1560	16 39 38
5	11 27 39.899 7.023	4 18 08.58 47.57	.84	.47	.63486 1551	16 35 49
6	11 27 46.922 + 7.194	+ 4 17 21.01 -48.66	1.84	0.47	18.65037 +1540	16 32 00
7	11 27 54.116 7.363	4 16 32.35 49.71	.84	.47	.66577 1529	16 28 11
8	11 28 01.479 7.528	4 15 42.64 50.76	.84	.47	.68106 1518	16 24 23
9	11 28 09.007 7.689	4 14 51.88 51.77	.83	.47	.69624 1507	16 20 34
10	11 28 16.696 7.850	4 14 00.11 52.79	.83	.47	.71131 1494	16 16 46
11	11 28 24.546 + 8.007	+ 4 13 07.32 -53.78	1.83	0.47	18.72625 +1482	16 12 58
12	11 28 32.553 8.163	4 12 13.54 54.77	.83	.47	.74107 1469	16 09 10
13	11 28 40.716 8.320	4 11 18.77 55.77	.83	.47	.75576 1456	16 05 23
14	11 28 49.036 8.475	4 10 23.00 56.74	.83	.47	.77032 1442	16 01 35
15	11 28 57.511 8.630	4 09 26.26 57.74	.82	.47	.78474 1429	15 57 48
16	11 29 06.141 + 8.785	+ 4 08 28.52 -58.70	1.82	0.47	18.79903 +1414	15 54 01
17	11 29 14.926 8.937	4 07 29.82 59.66	.82	.47	.81317 1399	15 50 13
18	11 29 23.863 9.087	4 06 30.16 60.59	.82	.47	.82716 1384	15 46 26
19	11 29 32.950 9.232	4 05 29.57 61.51	.82	.47	.84100 1370	15 42 40
20	11 29 42.182 9.376	4 04 28.06 62.41	.82	.47	.85470 1353	15 38 53
21	11 29 51.558 + 9.514	+ 4 03 25.65 -63.27	1.82	0.47	18.86823 +1338	15 35 07
22	11 30 01.072 9.652	4 02 22.38 64.13	.82	.47	.88161 1322	15 31 20
23	11 30 10.724 9.786	4 01 18.25 64.98	.81	.47	.89483 1305	15 27 34
24	11 30 20.510 9.920	4 00 13.27 65.81	.81	.47	.90788 1289	15 23 48
25	11 30 30.430 10.052	3 59 07.46 66.64	.81	.47	.92077 1271	15 20 02
26	11 30 40.482 +10.184	+ 3 58 00.82 -67.47	1.81	0.46	18.93348 +1255	15 16 16
27	11 30 50.666 10.314	3 56 53.35 68.30	.81	.46	.94603 1236	15 12 30
28	11 31 00.980 10.444	3 55 45.05 69.11	.81	.46	.95839 1218	15 08 45
29	11 31 11.424 10.573	3 54 35.94 69.91	.81	.46	.97057 1200	15 04 59
30	11 31 21.997 10.700	3 53 26.03 70.72	.81	.46	.98257 1182	15 01 14
Aug.						
31	11 31 32.697 +10.826	+ 3 52 15.31 -71.50	1.80	0.46	18.99439 +1162	14 57 29
1	11 31 43.523 10.949	3 51 03.81 72.27	.80	.46	19.00601 1143	14 53 44
2	11 31 54.472 11.069	3 49 51.54 73.03	.80	.46	.01744 1123	14 49 59
3	11 32 05.541 11.187	3 48 38.51 73.76	.80	.46	.02867 1104	14 46 14
4	11 32 16.728 11.300	3 47 24.75 74.46	.80	.46	.03971 1083	14 42 29
5	11 32 28.028 +11.411	+ 3 46 10.29 -75.15	1.80	0.46	19.05054 +1062	14 38 45
6	11 32 39.439 11.518	3 44 55.14 75.82	.80	.46	.06116 1042	14 35 00
7	11 32 50.957 11.621	3 43 39.32 76.46	.80	.46	.07158 1021	14 31 16
8	11 33 02.578 11.723	3 42 22.86 77.11	.80	.46	.08179 999	14 27 32
9	11 33 14.301 11.824	3 41 05.75 77.73	.80	.46	.09178 977	14 23 47
10	11 33 26.125 +11.924	+ 3 39 48.02 -78.36	1.79	0.46	19.10155 +956	14 20 03
11	11 33 38.049 12.023	3 38 29.66 78.98	.79	.46	.11111 933	14 16 19
12	11 33 50.072 12.121	3 37 10.68 79.59	.79	.46	.12044 911	14 12 35
13	11 34 02.193 12.217	3 35 51.09 80.18	.79	.46	.12955 888	14 08 52
14	11 34 14.410 12.309	3 34 30.91 80.75	.79	.46	.13843 866	14 05 08
15	11 34 26.719 +12.398	+ 3 33 10.16 -81.29	1.79	0.46	19.14709 +843	14 01 24
16	11 34 39.117	+ 3 31 48.87	1.79	0.46	19.15552	13 57 41

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Aug. 16	11 34 39.117	+ 3 31 48.87	1.79	0.46	19.15552	13 57 41
17	11 34 51.599	3 30 27.07	.79	.46	.16371	13 53 57
18	11 35 04.162	3 29 04.77	.79	.46	.17167	13 50 14
19	11 35 16.803	3 27 42.00	.79	.46	.17940	13 46 31
20	11 35 29.519	3 26 18.76	.79	.46	.18690	13 42 47
21	11 35 42.308	+ 3 24 55.08	1.79	0.46	19.19415	13 39 04
22	11 35 55.169	3 23 30.96	.79	.46	.20116	13 35 21
23	11 36 08.100	3 22 06.41	.78	.46	.20794	13 31 38
24	11 36 21.100	3 20 41.44	.78	.46	.21447	13 27 55
25	11 36 34.168	3 19 16.06	.78	.46	.22075	13 24 12
26	11 36 47.301	+ 3 17 50.27	1.78	0.46	19.22679	13 20 30
27	11 37 00.500	3 16 24.09	.78	.46	.23258	13 16 47
28	11 37 13.761	3 14 57.54	.78	.46	.23812	13 13 04
29	11 37 27.082	3 13 30.62	.78	.46	.24340	13 09 22
30	11 37 40.460	3 12 03.35	.78	.46	.24843	13 05 39
Sept. 31	11 37 53.891	+ 3 10 35.77	1.78	0.46	19.25321	13 01 56
1	11 38 07.372	3 09 07.90	.78	.46	.25773	12 58 14
2	11 38 20.901	3 07 39.74	.78	.46	.26198	12 54 32
3	11 38 34.470	3 06 11.35	.78	.46	.26598	12 50 49
4	11 38 48.079	3 04 42.72	.78	.46	.26972	12 47 07
5	11 39 01.725	+ 3 03 13.89	1.78	0.46	19.27319	12 43 25
6	11 39 15.404	3 01 44.86	.78	.46	.27640	12 39 42
7	11 39 29.117	3 00 15.63	.78	.46	.27934	12 36 00
8	11 39 42.863	2 58 46.22	.78	.46	.28202	12 32 18
9	11 39 56.640	2 57 16.63	.78	.46	.28443	12 28 36
10	11 40 10.445	+ 2 55 46.89	1.78	0.46	19.28657	12 24 53
11	11 40 24.276	2 54 17.01	.78	.46	.28844	12 21 11
12	11 40 38.128	2 52 47.03	.78	.46	.29005	12 17 29
13	11 40 51.997	2 51 16.97	.78	.46	.29139	12 13 47
14	11 41 05.879	2 49 46.85	.78	.46	.29246	12 10 05
15	11 41 19.770	+ 2 48 16.71	1.78	0.46	19.29326	12 06 23
16	11 41 33.669	2 46 46.55	.78	.46	.29379	12 02 41
17	11 41 47.572	2 45 16.39	.78	.46	.29406	11 58 59
18	11 42 01.477	2 43 46.25	.78	.46	.29405	11 55 17
19	11 42 15.383	2 42 16.13	.78	.46	.29378	11 51 35
20	11 42 29.288	+ 2 40 46.05	1.78	0.46	19.29324	11 47 52
21	11 42 43.191	2 39 16.00	.78	.46	.29243	11 44 10
22	11 42 57.089	2 37 46.01	.78	.46	.29135	11 40 28
23	11 43 10.983	2 36 16.08	.78	.46	.28999	11 36 46
24	11 43 24.868	2 34 46.24	.78	.46	.28837	11 33 04
25	11 43 38.742	+ 2 33 16.49	1.78	0.46	19.28648	11 29 22
26	11 43 52.603	2 31 46.86	.78	.46	.28432	11 25 40
27	11 44 06.448	2 30 17.38	.78	.46	.28189	11 21 58
28	11 44 20.272	2 28 48.05	.78	.46	.27919	11 18 16
29	11 44 34.071	2 27 18.91	.78	.46	.27622	11 14 33
30	11 44 47.843	+ 2 25 49.98	1.78	0.46	19.27298	11 10 51
Oct. 1	11 45 01.582	+ 2 24 21.29	1.78	0.46	19.26947	11 07 09

URANUS, 1967 FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Oct.	1	11 45 01.582		+	2 24 21.29	-88.43	1.78	0.46	19.26947	-	377	11 07 09
	2	11 45 15.286	+13.704		2 22 52.86	-88.16	.78	.46	.26570	-	405	11 03 27
	3	11 45 28.953	13.667		2 21 24.70	87.88	.78	.46	.26165		431	10 59 44
	4	11 45 42.581	13.628		2 19 56.82	87.59	.78	.46	.25734		459	10 56 02
	5	11 45 56.168	13.587		2 18 29.23	87.30	.78	.46	.25275		484	10 52 19
	6	11 46 09.716	13.548	+	2 17 01.93	-86.99	1.78	0.46	19.24791	-	511	10 48 37
	7	11 46 23.220	+13.504		2 15 34.94	86.66	.78	.46	.24280	-	538	10 44 54
	8	11 46 36.678	13.458		2 14 08.28	86.29	.78	.46	.23742		563	10 41 12
	9	11 46 50.085	13.407		2 12 41.99	85.91	.78	.46	.23179		590	10 37 29
	10	11 47 03.438	13.353		2 11 16.08	85.49	.78	.46	.22589		615	10 33 47
	11	11 47 16.731	13.293	+	2 09 50.59	-85.04	1.78	0.46	19.21974	-	641	10 30 04
	12	11 47 29.961	+13.230		2 08 25.55	84.58	.78	.46	.21333	-	667	10 26 21
	13	11 47 43.126	13.165		2 07 00.97	84.10	.78	.46	.20666		692	10 22 38
	14	11 47 56.222	13.096		2 05 36.87	83.62	.79	.46	.19974		717	10 18 55
	15	11 48 09.247	13.025		2 04 13.25	83.12	.79	.46	.19257		742	10 15 12
	16	11 48 22.200	12.953	+	2 02 50.13	-82.60	1.79	0.46	19.18515	-	767	10 11 29
	17	11 48 35.081	+12.881		2 01 27.53	82.09	.79	.46	.17748	-	792	10 07 46
	18	11 48 47.886	12.805		2 00 05.44	81.56	.79	.46	.16956		816	10 04 03
	19	11 49 00.614	12.728		1 58 43.88	81.01	.79	.46	.16140		840	10 00 20
	20	11 49 13.263	12.649		1 57 22.87	80.47	.79	.46	.15300		865	9 56 36
	21	11 49 25.831	12.568	+	1 56 02.40	-79.89	1.79	0.46	19.14435	-	888	9 52 53
	22	11 49 38.317	+12.486		1 54 42.51	79.30	.79	.46	.13547	-	912	9 49 10
	23	11 49 50.716	12.399		1 53 23.21	78.69	.79	.46	.12635		936	9 45 26
	24	11 50 03.026	12.310		1 52 04.52	78.06	.79	.46	.11699		960	9 41 42
	25	11 50 15.244	12.218		1 50 46.46	77.40	.79	.46	.10739		982	9 37 58
	26	11 50 27.365	12.121	+	1 49 29.06	-76.73	1.79	0.46	19.09757	-	1006	9 34 15
	27	11 50 39.386	+12.021		1 48 12.33	76.02	.80	.46	.08751	-	1028	9 30 30
	28	11 50 51.304	11.918		1 46 56.31	75.29	.80	.46	.07723		1051	9 26 46
	29	11 51 03.115	11.811		1 45 41.02	74.56	.80	.46	.06672		1073	9 23 02
	30	11 51 14.817	11.702		1 44 26.46	73.80	.80	.46	.05599		1096	9 19 18
	31	11 51 26.406	11.589	+	1 43 12.66	-73.04	1.80	0.46	19.04503	-	1117	9 15 33
Nov.	1	11 51 37.884	+11.478		1 41 59.62	72.29	.80	.46	.03386	-	1139	9 11 49
	2	11 51 49.250	11.366		1 40 47.33	71.51	.80	.46	.02247		1160	9 08 04
	3	11 52 00.500	11.250		1 39 35.82	70.73	.80	.46	19.01087		1181	9 04 20
	4	11 52 11.635	11.135		1 38 25.09	69.91	.80	.46	18.99906		1202	9 00 35
	5	11 52 22.649	11.014	+	1 37 15.18	-69.07	1.81	0.46	18.98704	-	1222	8 56 50
	6	11 52 33.538	+10.889		1 36 06.11	68.19	.81	.46	.97482	-	1241	8 53 05
	7	11 52 44.298	10.760		1 34 57.92	67.30	.81	.46	.96241		1262	8 49 19
	8	11 52 54.926	10.628		1 33 50.62	66.38	.81	.46	.94979		1280	8 45 34
	9	11 53 05.417	10.491		1 32 44.24	65.46	.81	.46	.93699		1300	8 41 48
	10	11 53 15.770	10.353	+	1 31 38.78	-64.51	1.81	0.47	18.92399	-	1317	8 38 03
	11	11 53 25.982	+10.212		1 30 34.27	63.57	.81	.47	.91082	-	1336	8 34 17
	12	11 53 36.054	10.072		1 29 30.70	62.61	.81	.47	.89746		1354	8 30 31
	13	11 53 45.982	9.928		1 28 28.09	61.65	.82	.47	.88392		1371	8 26 45
	14	11 53 55.767	9.785		1 27 26.44	60.69	.82	.47	.87021		1389	8 22 59
	15	11 54 05.407	9.640	+	1 26 25.75	-59.70	1.82	0.47	18.85632	-	1405	8 19 12
	16	11 54 14.901	+9.494		1 25 26.05		1.82	0.47	18.84227			8 15 26

FOR 0^h EPHEMERIS TIME

Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] [″]				^h ^m ^s
Nov. 16	11 54 14.901 + 9.346	+ 1 25 26.05 - 58.71	1.82	0.47	18.84227 -1421	8 15 26
17	11 54 24.247 9.196	1 24 27.34 57.72	.82	.47	.82806 1437	8 11 39
18	11 54 33.443 9.044	1 23 29.62 56.71	.82	.47	.81369 1453	8 07 52
19	11 54 42.487 8.890	1 22 32.91 55.67	.82	.47	.79916 1469	8 04 05
20	11 54 51.377 8.731	1 21 37.24 54.62	.82	.47	.78447 1483	8 00 18
21	11 55 00.108 + 8.572	+ 1 20 42.62 - 53.56	1.83	0.47	18.76964 -1498	7 56 31
22	11 55 08.680 8.407	1 19 49.06 52.47	.83	.47	.75466 1512	7 52 43
23	11 55 17.087 8.240	1 18 56.59 51.36	.83	.47	.73954 1526	7 48 56
24	11 55 25.327 8.070	1 18 05.23 50.23	.83	.47	.72428 1539	7 45 08
25	11 55 33.397 7.899	1 17 15.00 49.10	.83	.47	.70889 1553	7 41 20
26	11 55 41.296 + 7.726	+ 1 16 25.90 - 47.95	1.83	0.47	18.69336 -1565	7 37 32
27	11 55 49.022 7.552	1 15 37.95 46.80	.84	.47	.67771 1577	7 33 44
28	11 55 56.574 7.378	1 14 51.15 45.64	.84	.47	.66194 1589	7 29 55
29	11 56 03.952 7.203	1 14 05.51 44.49	.84	.47	.64605 1600	7 26 07
30	11 56 11.155 7.028	1 13 21.02 43.34	.84	.47	.63005 1611	7 22 18
Dec. 1	11 56 18.183 - 6.850	+ 1 12 37.68 - 42.15	1.84	0.47	18.61394 -1621	7 18 29
2	11 56 25.033 6.669	1 11 55.53 40.95	.84	.47	.59773 1632	7 14 40
3	11 56 31.702 6.484	1 11 14.58 39.73	.84	.47	.58141 1640	7 10 50
4	11 56 38.186 6.296	1 10 34.85 38.49	.85	.47	.56501 1649	7 07 01
5	11 56 44.482 6.104	1 09 56.36 37.22	.85	.47	.54852 1658	7 03 11
6	11 56 50.586 + 5.912	+ 1 09 19.14 - 35.95	1.85	0.47	18.53194 -1665	6 59 21
7	11 56 56.498 5.718	1 08 43.19 34.68	.85	.48	.51529 1673	6 55 31
8	11 57 02.216 5.524	1 08 08.51 33.39	.85	.48	.49856 1680	6 51 41
9	11 57 07.740 5.329	1 07 35.12 32.12	.85	.48	.48176 1685	6 47 50
10	11 57 13.069 5.135	1 07 03.00 30.83	.86	.48	.46491 1692	6 44 00
11	11 57 18.204 + 4.940	+ 1 06 32.17 - 29.56	1.86	0.48	18.44799 -1697	6 40 09
12	11 57 23.144 4.746	1 06 02.61 28.28	.86	.48	.43102 1702	6 36 18
13	11 57 27.890 4.550	1 05 34.33 27.00	.86	.48	.41400 1706	6 32 27
14	11 57 32.440 4.354	1 05 07.33 25.71	.86	.48	.39694 1710	6 28 35
15	11 57 36.794 4.158	1 04 41.62 24.42	.87	.48	.37984 1713	6 24 43
16	11 57 40.952 + 3.959	+ 1 04 17.20 - 23.13	1.87	0.48	18.36271 -1716	6 20 52
17	11 57 44.911 3.758	1 03 54.07 21.81	.87	.48	.34555 1719	6 17 00
18	11 57 48.669 3.557	1 03 32.26 20.49	.87	.48	.32836 1720	6 13 07
19	11 57 52.226 3.353	1 03 11.77 19.16	.87	.48	.31116 1723	6 09 15
20	11 57 55.579 3.146	1 02 52.61 17.81	.87	.48	.29393 1723	6 05 22
21	11 57 58.725 + 2.940	+ 1 02 34.80 - 16.47	1.88	0.48	18.27670 -1723	6 01 30
22	11 58 01.665 2.731	1 02 18.33 15.10	.88	.48	.25947 1724	5 57 36
23	11 58 04.396 2.523	1 02 03.23 13.76	.88	.48	.24223 1723	5 53 43
24	11 58 06.919 2.315	1 01 49.47 12.39	.88	.48	.22500 1722	5 49 50
25	11 58 09.234 2.108	1 01 37.08 11.05	.88	.48	.20778 1720	5 45 56
26	11 58 11.342 + 1.902	+ 1 01 26.03 - 9.70	1.88	0.48	18.19058 -1718	5 42 02
27	11 58 13.244 1.697	1 01 16.33 8.37	.89	.48	.17340 1716	5 38 08
28	11 58 14.941 1.491	1 01 07.96 7.03	.89	.49	.15624 1712	5 34 14
29	11 58 16.432 1.285	1 01 00.93 5.69	.89	.49	.13912 1709	5 30 19
30	11 58 17.717 1.075	1 00 55.24 4.33	.89	.49	.12203 1704	5 26 25
31	11 58 18.792 + 0.865	+ 1 00 50.91 - 2.96	1.89	0.49	18.10499 -1699	5 22 30
32	11 58 19.657	+ 1 00 47.95	1.90	0.49	18.08800	5 18 35

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
Jan.	^{h m s} 0 15 26 15.137	^{° ' "} -17 00 16.45	1.18	0.28	31.00537	^{h m s} 8 48 58
	1 15 26 22.074	17 00 39.50	1.18	0.28	30.99290	8 45 09
	2 15 26 28.916	17 01 02.12	1.18	0.28	30.98022	8 41 19
	3 15 26 35.663	17 01 24.32	1.18	0.28	30.96734	8 37 30
	4 15 26 42.315	17 01 46.09	1.18	0.28	30.95427	8 33 41
	5 15 26 48.872	17 02 07.44	1.18	0.28	30.94100	8 29 51
	6 15 26 55.333	17 02 28.36	1.18	0.28	30.92754	8 26 02
	7 15 27 01.698	17 02 48.88	1.18	0.28	30.91389	8 22 12
	8 15 27 07.962	17 03 08.98	1.18	0.28	30.90006	8 18 23
	9 15 27 14.125	17 03 28.68	1.18	0.28	30.88605	8 14 33
	10 15 27 20.182	17 03 47.96	1.18	0.29	30.87186	8 10 43
	11 15 27 26.131	17 04 06.81	1.18	0.29	30.85751	8 06 53
	12 15 27 31.967	17 04 25.21	1.19	0.29	30.84299	8 03 03
	13 15 27 37.691	17 04 43.16	1.19	0.29	30.82831	7 59 12
	14 15 27 43.300	17 05 00.64	1.19	0.29	30.81347	7 55 22
	15 15 27 48.793	17 05 17.65	1.19	0.29	30.79848	7 51 32
	16 15 27 54.170	17 05 34.19	1.19	0.29	30.78335	7 47 41
	17 15 27 59.430	17 05 50.25	1.19	0.29	30.76807	7 43 50
	18 15 28 04.573	17 06 05.82	1.19	0.29	30.75265	7 39 59
	19 15 28 09.599	17 06 20.92	1.19	0.29	30.73710	7 36 08
	20 15 28 14.508	17 06 35.55	1.19	0.29	30.72143	7 32 17
	21 15 28 19.299	17 06 49.71	1.19	0.29	30.70563	7 28 26
	22 15 28 23.972	17 07 03.41	1.19	0.29	30.68971	7 24 35
	23 15 28 28.525	17 07 16.64	1.19	0.29	30.67368	7 20 43
	24 15 28 32.957	17 07 29.42	1.19	0.29	30.65754	7 16 52
	25 15 28 37.264	17 07 41.74	1.19	0.29	30.64130	7 13 00
	26 15 28 41.446	17 07 53.59	1.19	0.29	30.62495	7 09 08
	27 15 28 45.498	17 08 04.97	1.19	0.29	30.60851	7 05 17
	28 15 28 49.419	17 08 15.85	1.20	0.29	30.59198	7 01 25
	29 15 28 53.209	17 08 26.22	1.20	0.29	30.57536	6 57 32
	30 15 28 56.866	17 08 36.07	1.20	0.29	30.55866	6 53 40
	31 15 29 00.395	17 08 45.41	1.20	0.29	30.54189	6 49 48
Feb.	1 15 29 03.794	17 08 54.24	1.20	0.29	30.52504	6 45 55
	2 15 29 07.065	17 09 02.57	1.20	0.29	30.50813	6 42 02
	3 15 29 10.207	17 09 10.41	1.20	0.29	30.49115	6 38 10
	4 15 29 13.218	17 09 17.77	1.20	0.29	30.47411	6 34 17
	5 15 29 16.098	17 09 24.65	1.20	0.29	30.45702	6 30 23
	6 15 29 18.843	17 09 31.05	1.20	0.29	30.43989	6 26 30
	7 15 29 21.452	17 09 36.95	1.20	0.29	30.42271	6 22 37
	8 15 29 23.923	17 09 42.36	1.20	0.29	30.40550	6 18 43
	9 15 29 26.254	17 09 47.26	1.20	0.29	30.38826	6 14 50
	10 15 29 28.445	17 09 51.65	1.20	0.29	30.37099	6 10 56
	11 15 29 30.495	17 09 55.52	1.20	0.29	30.35370	6 07 02
	12 15 29 32.406	17 09 58.87	1.21	0.29	30.33640	6 03 08
	13 15 29 34.177	17 10 01.69	1.21	0.29	30.31909	5 59 14
	14 15 29 35.811	17 10 04.00	1.21	0.29	30.30178	5 55 20
	15 15 29 37.306	17 10 05.81	1.21	0.29	30.28447	5 51 25

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	15 29 37.306 +1.359	-17 10 05.81 - 1.29	1.21	0.29	30.28447 -1730	5 51 25
16	15 29 38.665 1.222	17 10 07.10 0.79	.21	.29	.26717 1729	5 47 31
17	15 29 39.887 1.088	17 10 07.89 - 0.31	.21	.29	.24988 1727	5 43 36
18	15 29 40.975 0.950	17 10 08.20 + 0.17	.21	.29	.23261 1724	5 39 41
19	15 29 41.925 0.816	17 10 08.03 0.64	.21	.29	.21537 1722	5 35 46
20	15 29 42.741 +0.677	-17 10 07.39 + 1.12	1.21	0.29	30.19815 -1718	5 31 51
21	15 29 43.418 0.540	17 10 06.27 1.59	.21	.29	.18097 1714	5 27 56
22	15 29 43.958 0.400	17 10 04.68 2.06	.21	.29	.16383 1710	5 24 00
23	15 29 44.358 0.259	17 10 02.62 2.56	.21	.29	.14673 1705	5 20 05
24	15 29 44.617 +0.118	17 10 00.06 3.05	.21	.29	.12968 1699	5 16 09
25	15 29 44.735 -0.022	-17 09 57.01 + 3.56	1.21	0.29	30.11269 -1694	5 12 13
26	15 29 44.713 0.160	17 09 53.45 4.07	.21	.29	.09575 1687	5 08 17
27	15 29 44.553 0.295	17 09 49.38 4.56	.22	.29	.07888 1680	5 04 21
28	15 29 44.258 0.428	17 09 44.82 5.06	.22	.29	.06208 1674	5 00 25
Mar. 1	15 29 43.830 0.561	17 09 39.76 5.52	.22	.29	.04534 1665	4 56 28
2	15 29 43.269 -0.693	-17 09 34.24 + 5.98	1.22	0.29	30.02869 -1657	4 52 32
3	15 29 42.576 0.825	17 09 28.26 6.42	.22	.29	30.01212 1648	4 48 35
4	15 29 41.751 0.959	17 09 21.84 6.88	.22	.29	29.99564 1639	4 44 39
5	15 29 40.792 1.094	17 09 14.96 7.32	.22	.29	.97925 1629	4 40 42
6	15 29 39.698 1.230	17 09 07.64 7.79	.22	.29	.96296 1619	4 36 45
7	15 29 38.468 -1.366	-17 08 59.85 + 8.23	1.22	0.29	29.94677 -1608	4 32 48
8	15 29 37.102 1.500	17 08 51.62 8.71	.22	.29	.93069 1597	4 28 50
9	15 29 35.602 1.635	17 08 42.91 9.16	.22	.29	.91472 1584	4 24 53
10	15 29 33.967 1.767	17 08 33.75 9.63	.22	.29	.89888 1572	4 20 55
11	15 29 32.200 1.899	17 08 24.12 10.09	.22	.29	.88316 1559	4 16 58
12	15 29 30.301 -2.028	-17 08 14.03 +10.54	1.22	0.29	29.86757 -1546	4 13 00
13	15 29 28.273 2.154	17 08 03.49 10.99	.22	.29	.85211 1532	4 09 02
14	15 29 26.119 2.279	17 07 52.50 11.43	.23	.29	.83679 1517	4 05 04
15	15 29 23.840 2.402	17 07 41.07 11.84	.23	.30	.82162 1502	4 01 06
16	15 29 21.438 2.523	17 07 29.23 12.25	.23	.30	.80660 1487	3 57 07
17	15 29 18.915 -2.643	-17 07 16.98 +12.66	1.23	0.30	29.79173 -1472	3 53 09
18	15 29 16.272 2.763	17 07 04.32 13.04	.23	.30	.77701 1455	3 49 10
19	15 29 13.509 2.881	17 06 51.28 13.42	.23	.30	.76246 1438	3 45 12
20	15 29 10.628 2.999	17 06 37.86 13.80	.23	.30	.74808 1421	3 41 13
21	15 29 07.629 3.118	17 06 24.06 14.17	.23	.30	.73387 1403	3 37 14
22	15 29 04.511 -3.235	-17 06 09.89 +14.56	1.23	0.30	29.71984 -1386	3 33 15
23	15 29 01.276 3.354	17 05 55.33 14.93	.23	.30	.70598 1367	3 29 16
24	15 28 57.922 3.470	17 05 40.40 15.34	.23	.30	.69231 1349	3 25 16
25	15 28 54.452 3.584	17 05 25.06 15.72	.23	.30	.67882 1330	3 21 17
26	15 28 50.868 3.692	17 05 09.34 16.11	.23	.30	.66552 1310	3 17 18
27	15 28 47.176 -3.799	-17 04 53.23 +16.48	1.23	0.30	29.65242 -1291	3 13 18
28	15 28 43.377 3.902	17 04 36.75 16.83	.23	.30	.63951 1270	3 09 18
29	15 28 39.475 4.003	17 04 19.92 17.16	.23	.30	.62681 1250	3 05 18
30	15 28 35.472 4.104	17 04 02.76 17.47	.23	.30	.61431 1229	3 01 19
31	15 28 31.368 4.204	17 03 45.29 17.79	.24	.30	.60202 1208	2 57 19
Apr. 1	15 28 27.164 -4.306	-17 03 27.50 +18.09	1.24	0.30	29.58994 -1187	2 53 18
2	15 28 22.858	-17 03 09.41	1.24	0.30	29.57807	2 49 18

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	15 28 27.164	-17 03 27.50	1.24	0.30	29.58994	2 53 18
2	15 28 22.858	17 03 09.41	.24	.30	.57807	2 49 18
3	15 28 18.451	17 02 51.01	.24	.30	.56643	2 45 18
4	15 28 13.943	17 02 32.29	.24	.30	.55501	2 41 18
5	15 28 09.338	17 02 13.26	.24	.30	.54382	2 37 17
6	15 28 04.636	-17 01 53.92	1.24	0.30	29.53286	2 33 17
7	15 27 59.839	17 01 34.28	.24	.30	.52214	2 29 16
8	15 27 54.952	17 01 14.33	.24	.30	.51165	2 25 15
9	15 27 49.976	17 00 54.10	.24	.30	.50140	2 21 14
10	15 27 44.915	17 00 33.58	.24	.30	.49140	2 17 13
11	15 27 39.773	-17 00 12.80	1.24	0.30	29.48165	2 13 12
12	15 27 34.551	16 59 51.76	.24	.30	.47215	2 09 11
13	15 27 29.253	16 59 30.49	.24	.30	.46290	2 05 10
14	15 27 23.881	16 59 09.00	.24	.30	.45391	2 01 09
15	15 27 18.437	16 58 47.30	.24	.30	.44518	1 57 07
16	15 27 12.921	-16 58 25.41	1.24	0.30	29.43671	1 53 06
17	15 27 07.337	16 58 03.32	.24	.30	.42851	1 49 04
18	15 27 01.684	16 57 41.05	.24	.30	.42057	1 45 03
19	15 26 55.964	16 57 18.60	.24	.30	.41290	1 41 01
20	15 26 50.179	16 56 55.96	.24	.30	.40550	1 37 00
21	15 26 44.329	-16 56 33.14	1.24	0.30	29.39837	1 32 58
22	15 26 38.418	16 56 10.13	.24	.30	.39151	1 28 56
23	15 26 32.451	16 55 46.94	.24	.30	.38493	1 24 54
24	15 26 26.432	16 55 23.58	.24	.30	.37863	1 20 52
25	15 26 20.364	16 55 00.07	.24	.30	.37260	1 16 50
26	15 26 14.252	-16 54 36.44	1.24	0.30	29.36685	1 12 48
27	15 26 08.097	16 54 12.71	.25	.30	.36138	1 08 46
28	15 26 01.899	16 53 48.89	.25	.30	.35620	1 04 44
29	15 25 55.658	16 53 24.98	.25	.30	.35130	1 00 42
30	15 25 49.377	16 53 00.99	.25	.30	.34668	0 56 40
May 1	15 25 43.055	-16 52 36.90	1.25	0.30	29.34236	0 52 38
2	15 25 36.693	16 52 12.73	.25	.30	.33832	0 48 36
3	15 25 30.296	16 51 48.49	.25	.30	.33457	0 44 33
4	15 25 23.866	16 51 24.15	.25	.30	.33111	0 40 31
5	15 25 17.405	16 50 59.75	.25	.30	.32795	0 36 29
6	15 25 10.919	-16 50 35.30	1.25	0.30	29.32508	0 32 26
7	15 25 04.410	16 50 10.79	.25	.30	.32250	0 28 24
8	15 24 57.882	16 49 46.26	.25	.30	.32022	0 24 22
9	15 24 51.338	16 49 21.70	.25	.30	.31823	0 20 19
10	15 24 44.782	16 48 57.15	.25	.30	.31655	0 16 17
11	15 24 38.217	-16 48 32.61	1.25	0.30	29.31516	0 12 14
12	15 24 31.644	16 48 08.11	.25	.30	.31406	0 08 12
13	15 24 25.066	16 47 43.65	.25	.30	.31326	0 04 09
14	15 24 18.484	16 47 19.24	.25	.30	.31276	{ 0 00 07 }
15	15 24 11.899	16 46 54.90	.25	.30	.31256	{ 23 56 04 }
16	15 24 05.314	-16 46 30.62	1.25	0.30	29.31266	23 48 00
17	15 23 58.728	-16 46 06.40	1.25	0.30	29.31305	23 43 57

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] [″]	″	″		^h ^m ^s
May 17	15 23 58.728 -6.582	-16 46 06.40 +24.15	1.25 .25	0.30 .30	29.31305 + 68 .31373 98	23 43 57 23 39 55
18	15 23 52.146 6.577	16 45 42.25 24.10	.25	.30	.31471 127	23 35 52
19	15 23 45.569 6.567	16 45 18.15 24.03	.25	.30	.31598 157	23 31 50
20	15 23 39.002 6.553	16 44 54.12 23.94	.25	.30	.31755 185	23 27 47
21	15 23 32.449 6.536	16 44 30.18 23.84	.25	.30		
22	15 23 25.913 -6.513	-16 44 06.34 +23.73	1.25 .25	0.30 .30	29.31940 + 215 .32155 244	23 23 45 23 19 43
23	15 23 19.400 6.488	16 43 42.61 23.58	.25	.30	.32399 272	23 15 40
24	15 23 12.912 6.463	16 43 19.03 23.43	.25	.30	.32671 302	23 11 38
25	15 23 06.449 6.437	16 42 55.60 23.26	.25	.30	.32973 330	23 07 36
26	15 23 00.012 6.411	16 42 32.34 23.09	.25	.30		
27	15 22 53.601 -6.384	-16 42 09.25 +22.93	1.25 .25	0.30 .30	29.33303 + 359 .33662 387	23 03 33 22 59 31
28	15 22 47.217 6.355	16 41 46.32 22.76	.25	.30	.34049 416	22 55 29
29	15 22 40.862 6.325	16 41 23.56 22.60	.25	.30	.34465 444	22 51 27
30	15 22 34.537 6.292	16 41 00.96 22.43	.25	.30	.34909 472	22 47 25
31	15 22 28.245 6.256	16 40 38.53 22.25	.25	.30		
June 1	15 22 21.989 -6.215	-16 40 16.28 +22.06	1.25 .25	0.30 .30	29.35381 + 500 .35881 529	22 43 23 22 39 20
2	15 22 15.774 6.172	16 39 54.22 21.87	.25	.30	.36410 556	22 35 18
3	15 22 09.602 6.126	16 39 32.35 21.66	.24	.30	.36966 583	22 31 17
4	15 22 03.476 6.075	16 39 10.69 21.43	.24	.30	.37549 612	22 27 15
5	15 21 57.401 6.023	16 38 49.26 21.19	.24	.30		
6	15 21 51.378 -5.966	-16 38 28.07 +20.93	1.24 .24	0.30 .30	29.38161 + 638 .38799 665	22 23 13 22 19 11
7	15 21 45.412 5.909	16 38 07.14 20.66	.24	.30	.39464 693	22 15 09
8	15 21 39.503 5.850	16 37 46.48 20.38	.24	.30	.40157 718	22 11 08
9	15 21 33.653 5.789	16 37 26.10 20.08	.24	.30	.40875 746	22 07 06
10	15 21 27.864 5.727	16 37 06.02 19.78	.24	.30		
11	15 21 22.137 -5.664	-16 36 46.24 +19.49	1.24 .24	0.30 .30	29.41621 + 771 .42392 797	22 03 04 21 59 03
12	15 21 16.473 5.601	16 36 26.75 19.19	.24	.30	.43189 823	21 55 02
13	15 21 10.872 5.536	16 36 07.56 18.89	.24	.30	.44012 847	21 51 00
14	15 21 05.336 5.468	16 35 48.67 18.60	.24	.30	.44859 873	21 46 59
15	15 20 59.868 5.397	16 35 30.07 18.31	.24	.30		
16	15 20 54.471 -5.323	-16 35 11.76 +17.99	1.24 .24	0.30 .30	29.45732 + 897 .46629 922	21 42 58 21 38 57
17	15 20 49.148 5.245	16 34 53.77 17.68	.24	.30	.47551 945	21 34 55
18	15 20 43.903 5.163	16 34 36.09 17.34	.24	.30	.48496 969	21 30 54
19	15 20 38.740 5.080	16 34 18.75 16.98	.24	.30	.49465 993	21 26 54
20	15 20 33.660 4.994	16 34 01.77 16.61	.24	.30		
21	15 20 28.666 -4.909	-16 33 45.16 +16.23	1.24 .24	0.30 .30	29.50458 + 1016 .51474 1038	21 22 53 21 18 52
22	15 20 23.757 4.823	16 33 28.93 15.85	.24	.30	.52512 1061	21 14 51
23	15 20 18.934 4.740	16 33 13.08 15.47	.24	.30	.53573 1083	21 10 51
24	15 20 14.194 4.655	16 32 57.61 15.09	.24	.30	.54656 1105	21 06 50
25	15 20 09.539 4.568	16 32 42.52 14.72	.24	.30		
26	15 20 04.971 -4.480	-16 32 27.80 +14.34	1.24 .24	0.30 .30	29.55761 + 1127 .56888 1148	21 02 50 20 58 50
27	15 20 00.491 4.391	16 32 13.46 13.98	.24	.30	.58036 1169	20 54 50
28	15 19 56.100 4.296	16 31 59.48 13.59	.24	.30	.59205 1189	20 50 49
29	15 19 51.804 4.201	16 31 45.89 13.20	.24	.30	.60394 1210	20 46 49
30	15 19 47.603 4.103	16 31 32.69 12.81	.23	.30		
July 1	15 19 43.500 -4.001	-16 31 19.88 +12.39	1.23 1.23	0.30 0.30	29.61604 + 1230 29.62834	20 42 50 20 38 50
2	15 19 39.499	-16 31 07.49				

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Date	Apparent Right Ascension				Apparent Declination				Semi- diam- eter	Hor. Par.	True Distance from the Earth				Ephem- eris Transit	
	h	m	s		°	'	"		"	"				h	m	s
July	1	15	19	43.500	-16	31	19.88	1.23	0.30	29.61604	+1230		20	42	50	
	2	15	19	39.499	-16	31	07.49	1.23	0.30	29.62834	+1250		20	38	50	
	3	15	19	35.601	-16	30	55.51	1.23	0.30	29.64084	+1269		20	34	50	
	4	15	19	31.809	-16	30	43.98	1.23	0.30	29.65353	+1288		20	30	50	
	5	15	19	28.123	-16	30	32.89	1.23	0.30	29.66641	+1306		20	26	51	
	6	15	19	24.545	-16	30	22.26	1.23	0.30	29.67947	+1324		20	22	52	
	7	15	19	21.076	-16	30	12.09	1.23	0.30	29.69271	+1342		20	18	52	
	8	15	19	17.716	-16	30	02.38	1.23	0.30	29.70613	+1360		20	14	53	
	9	15	19	14.464	-16	29	53.15	1.23	0.30	29.71973	+1376		20	10	54	
	10	15	19	11.320	-16	29	44.36	1.23	0.30	29.73349	+1393		20	06	55	
	11	15	19	08.286	-16	29	36.04	1.23	0.30	29.74742	+1408		20	02	56	
	12	15	19	05.362	-16	29	28.16	1.23	0.30	29.76150	+1424		19	58	58	
	13	15	19	02.550	-16	29	20.73	1.23	0.30	29.77574	+1439		19	54	59	
	14	15	18	59.855	-16	29	13.74	1.23	0.30	29.79013	+1454		19	51	00	
	15	15	18	57.277	-16	29	07.21	1.23	0.30	29.80467	+1468		19	47	02	
	16	15	18	54.819	-16	29	01.16	1.23	0.30	29.81935	+1482		19	43	04	
	17	15	18	52.484	-16	28	55.59	1.23	0.29	29.83417	+1495		19	39	06	
	18	15	18	50.272	-16	28	50.53	1.22	0.29	29.84912	+1507		19	35	08	
	19	15	18	48.182	-16	28	45.97	1.22	0.29	29.86419	+1520		19	31	10	
	20	15	18	46.214	-16	28	41.91	1.22	0.29	29.87939	+1532		19	27	12	
	21	15	18	44.366	-16	28	38.35	1.22	0.29	29.89471	+1544		19	23	14	
	22	15	18	42.637	-16	28	35.29	1.22	0.29	29.91015	+1555		19	19	17	
	23	15	18	41.027	-16	28	32.71	1.22	0.29	29.92570	+1566		19	15	19	
	24	15	18	39.538	-16	28	30.62	1.22	0.29	29.94136	+1576		19	11	22	
	25	15	18	38.169	-16	28	28.99	1.22	0.29	29.95712	+1586		19	07	25	
	26	15	18	36.924	-16	28	27.85	1.22	0.29	29.97298	+1596		19	03	28	
	27	15	18	35.802	-16	28	27.19	1.22	0.29	29.98894	+1604		18	59	31	
	28	15	18	34.807	-16	28	27.01	1.22	0.29	30.00498	+1614		18	55	34	
	29	15	18	33.940	-16	28	27.32	1.22	0.29	30.02112	+1621		18	51	38	
	30	15	18	33.202	-16	28	28.14	1.22	0.29	30.03733	+1630		18	47	41	
Aug.	31	15	18	32.595	-16	28	29.46	1.22	0.29	30.05363	+1636		18	43	45	
	1	15	18	32.118	-16	28	31.30	1.22	0.29	30.06999	+1643		18	39	48	
	2	15	18	31.774	-16	28	33.67	1.22	0.29	30.08642	+1650		18	35	52	
	3	15	18	31.559	-16	28	36.56	1.21	0.29	30.10292	+1656		18	31	56	
	4	15	18	31.476	-16	28	39.98	1.21	0.29	30.11948	+1661		18	28	00	
	5	15	18	31.521	-16	28	43.92	1.21	0.29	30.13609	+1666		18	24	04	
	6	15	18	31.695	-16	28	48.37	1.21	0.29	30.15275	+1670		18	20	09	
	7	15	18	31.996	-16	28	53.33	1.21	0.29	30.16945	+1674		18	16	13	
	8	15	18	32.425	-16	28	58.78	1.21	0.29	30.18619	+1677		18	12	18	
	9	15	18	32.982	-16	29	04.71	1.21	0.29	30.20296	+1681		18	08	23	
	10	15	18	33.669	-16	29	11.12	1.21	0.29	30.21977	+1682		18	04	27	
	11	15	18	34.487	-16	29	18.02	1.21	0.29	30.23659	+1684		18	00	32	
	12	15	18	35.440	-16	29	25.42	1.21	0.29	30.25343	+1686		17	56	38	
	13	15	18	36.527	-16	29	33.31	1.21	0.29	30.27029	+1686		17	52	43	
	14	15	18	37.748	-16	29	41.73	1.21	0.29	30.28715	+1687		17	48	48	
	15	15	18	39.103	-16	29	50.66	1.21	0.29	30.30402	+1687		17	44	54	
16	15	18	40.588	-16	30	00.10	1.21	0.29	30.32089	+1687		17	41	00		

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Date	Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
Aug. 16	^h 15 ^m 18 ^s 40.588	[°] -16 ['] 30 ["] 00.10	["] 1.21	["] 0.29	30.32089	^h 17 ^m 41 ^s 00
17	15 18 42.203	16 30 10.05	.21	.29	.33775	17 37 05
18	15 18 43.945	16 30 20.50	.20	.29	.35460	17 33 11
19	15 18 45.813	16 30 31.43	.20	.29	.37144	17 29 17
20	15 18 47.806	16 30 42.84	.20	.29	.38826	17 25 23
21	15 18 49.925	-16 30 54.71	1.20	0.29	30.40506	17 21 30
22	15 18 52.170	16 31 07.04	.20	.29	.42183	17 17 36
23	15 18 54.542	16 31 19.83	.20	.29	.43856	17 13 43
24	15 18 57.042	16 31 33.09	.20	.29	.45527	17 09 49
25	15 18 59.669	16 31 46.80	.20	.29	.47193	17 05 56
26	15 19 02.426	-16 32 00.98	1.20	0.29	30.48854	17 02 03
27	15 19 05.312	16 32 15.63	.20	.29	.50511	16 58 10
28	15 19 08.327	16 32 30.75	.20	.29	.52162	16 54 17
29	15 19 11.469	16 32 46.35	.20	.29	.53807	16 50 25
30	15 19 14.740	16 33 02.43	.20	.29	.55446	16 46 32
31	15 19 18.136	-16 33 18.98	1.20	0.29	30.57078	16 42 40
Sept. 1	15 19 21.656	16 33 36.01	.20	.29	.58703	16 38 47
2	15 19 25.299	16 33 53.49	.19	.29	.60320	16 34 55
3	15 19 29.062	16 34 11.41	.19	.29	.61929	16 31 03
4	15 19 32.943	16 34 29.77	.19	.29	.63529	16 27 11
5	15 19 36.944	-16 34 48.53	1.19	0.29	30.65120	16 23 19
6	15 19 41.063	16 35 07.71	.19	.29	.66701	16 19 27
7	15 19 45.303	16 35 27.29	.19	.29	.68272	16 15 36
8	15 19 49.664	16 35 47.27	.19	.29	.69832	16 11 44
9	15 19 54.147	16 36 07.68	.19	.29	.71381	16 07 53
10	15 19 58.752	-16 36 28.51	1.19	0.29	30.72918	16 04 02
11	15 20 03.474	16 36 49.76	.19	.29	.74443	16 00 11
12	15 20 08.313	16 37 11.43	.19	.29	.75956	15 56 20
13	15 20 13.266	16 37 33.51	.19	.29	.77456	15 52 29
14	15 20 18.329	16 37 55.99	.19	.29	.78943	15 48 38
15	15 20 23.500	-16 38 18.85	1.19	0.29	30.80417	15 44 47
16	15 20 28.778	16 38 42.08	.19	.29	.81876	15 40 57
17	15 20 34.163	16 39 05.66	.19	.29	.83321	15 37 06
18	15 20 39.653	16 39 29.59	.19	.29	.84751	15 33 16
19	15 20 45.248	16 39 53.86	.18	.29	.86166	15 29 25
20	15 20 50.949	-16 40 18.47	1.18	0.29	30.87566	15 25 35
21	15 20 56.755	16 40 43.41	.18	.28	.88949	15 21 45
22	15 21 02.667	16 41 08.69	.18	.28	.90317	15 17 55
23	15 21 08.683	16 41 34.31	.18	.28	.91668	15 14 05
24	15 21 14.803	16 42 00.27	.18	.28	.93002	15 10 16
25	15 21 21.026	-16 42 26.57	1.18	0.28	30.94319	15 06 26
26	15 21 27.349	16 42 53.21	.18	.28	.95617	15 02 36
27	15 21 33.772	16 43 20.17	.18	.28	.96898	14 58 47
28	15 21 40.291	16 43 47.47	.18	.28	.98160	14 54 58
29	15 21 46.904	16 44 15.08	.18	.28	30.99404	14 51 08
30	15 21 53.609	-16 44 42.98	1.18	0.28	31.00628	14 47 19
Oct. 1	15 22 00.403	-16 45 11.17	1.18	0.28	31.01833	14 43 30

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Date	Apparent Right Ascension			Apparent Declination			Semi- diam- eter	Hor. Par.	True Distance from the Earth			Ephem- eris Transit
	h	m	s	°	'	"	"	"				h m s
Oct.	1	15 22 00.403	+6.882	16 45 11.17	-28.46	1.18	0.28	31.01833	+1184			14 43 30
	2	15 22 07.285	6.969	16 45 39.63	-28.71	.18	.28	.03017	1164			14 39 41
	3	15 22 14.254	7.056	16 46 08.34	-28.95	.18	.28	.04181	1144			14 35 52
	4	15 22 21.310	7.144	16 46 37.29	-29.19	.18	.28	.05325	1122			14 32 03
	5	15 22 28.454	7.233	16 47 06.48	-29.44	.18	.28	.06447	1100			14 28 15
	6	15 22 35.687		16 47 35.92	-29.69	1.18	0.28	31.07547	+1079			14 24 26
	7	15 22 43.006	+7.319	16 48 05.61	-29.95	.18	.28	.08626	1057			14 20 37
	8	15 22 50.411	7.405	16 48 35.56	-30.21	.18	.28	.09683	1034			14 16 49
	9	15 22 57.897	7.486	16 49 05.77	-30.44	.18	.28	.10717	1012			14 13 00
	10	15 23 05.461	7.564	16 49 36.21	-30.67	.17	.28	.11729	988			14 09 12
			7.638									
	11	15 23 13.099		16 50 06.88	-30.88	1.17	0.28	31.12717	+966			14 05 24
	12	15 23 20.808	+7.709	16 50 37.76	-31.07	.17	.28	.13683	941			14 01 36
	13	15 23 28.586	7.778	16 51 08.83	-31.24	.17	.28	.14624	919			13 57 47
	14	15 23 36.431	7.845	16 51 40.07	-31.41	.17	.28	.15543	894			13 53 59
	15	15 23 44.343	7.912	16 52 11.48	-31.57	.17	.28	.16437	870			13 50 11
			7.976									
	16	15 23 52.319		16 52 43.05	-31.72	1.17	0.28	31.17307	+845			13 46 23
	17	15 24 00.361	+8.042	16 53 14.77	-31.87	.17	.28	.18152	821			13 42 36
	18	15 24 08.467	8.106	16 53 46.64	-32.01	.17	.28	.18973	796			13 38 48
	19	15 24 16.637	8.170	16 54 18.65	-32.16	.17	.28	.19769	771			13 35 00
	20	15 24 24.869	8.232	16 54 50.81	-32.31	.17	.28	.20540	746			13 31 12
			8.293									
	21	15 24 33.162		16 55 23.12	-32.45	1.17	0.28	31.21286	+720			13 27 25
	22	15 24 41.515	+8.353	16 55 55.57	-32.60	.17	.28	.22006	694			13 23 37
	23	15 24 49.926	8.411	16 56 28.17	-32.72	.17	.28	.22700	669			13 19 50
	24	15 24 58.391	8.465	16 57 00.89	-32.87	.17	.28	.23369	642			13 16 02
	25	15 25 06.908	8.517	16 57 33.76	-32.97	.17	.28	.24011	615			13 12 15
			8.567									
	26	15 25 15.475		16 58 06.73	-33.08	1.17	0.28	31.24626	+590			13 08 27
	27	15 25 24.088	+8.613	16 58 39.81	-33.17	.17	.28	.25216	562			13 04 40
	28	15 25 32.744	8.656	16 59 12.98	-33.24	.17	.28	.25778	535			13 00 53
	29	15 25 41.442	8.698	16 59 46.22	-33.29	.17	.28	.26313	508			12 57 06
	30	15 25 50.179	8.737	17 00 19.51	-33.33	.17	.28	.26821	480			12 53 18
			8.777									
Nov.	31	15 25 58.956		17 00 52.84	-33.36	1.17	0.28	31.27301	+453			12 49 31
	1	15 26 07.771	+8.815	17 01 26.20	-33.40	.17	.28	.27754	425			12 45 44
	2	15 26 16.626	8.855	17 01 59.60	-33.44	.17	.28	.28179	397			12 41 57
	3	15 26 25.519	8.893	17 02 33.04	-33.49	.17	.28	.28576	369			12 38 10
	4	15 26 34.448	8.929	17 03 06.53	-33.54	.17	.28	.28945	341			12 34 23
			8.963									
	5	15 26 43.411		17 03 40.07	-33.57	1.17	0.28	31.29286	+312			12 30 36
	6	15 26 52.402	+8.991	17 04 13.64	-33.60	.17	.28	.29598	284			12 26 49
	7	15 27 01.417	9.015	17 04 47.24	-33.60	.17	.28	.29882	255			12 23 02
	8	15 27 10.452	9.035	17 05 20.84	-33.59	.17	.28	.30137	227			12 19 15
	9	15 27 19.505	9.053	17 05 54.43	-33.54	.17	.28	.30364	198			12 15 28
			9.069									
	10	15 27 28.574		17 06 27.97	-33.51	1.17	0.28	31.30562	+169			12 11 41
	11	15 27 37.656	+9.082	17 07 01.48	-33.46	.17	.28	.30731	141			12 07 54
	12	15 27 46.751	9.095	17 07 34.94	-33.39	.17	.28	.30872	112			12 04 08
	13	15 27 55.858	9.107	17 08 08.33	-33.33	.17	.28	.30984	84			12 00 21
	14	15 28 04.976	9.118	17 08 41.66	-33.27	.17	.28	.31068	54			11 56 34
			9.128									
	15	15 28 14.104		17 09 14.93	-33.19	1.17	0.28	31.31122	+26			11 52 47
	16	15 28 23.241	+9.137	17 09 48.12	-33.19	1.17	0.28	31.31148				11 49 00

NEPTUNE, 1967

FOR 0^h EPHEMERIS TIME

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Date		Apparent Right Ascension	Apparent Declination	Semi- diam- eter	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
		^h ^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Nov.	16	15 28 23.241 ^s	-17 09 48.12	1.17	0.28	31.31148	11 49 00
	17	15 28 32.385 ^{+9.144}	17 10 21.26 ^{-33.14}	1.17	0.28	31.1146	11 45 13
	18	15 28 41.534 ^{9.149}	17 10 54.32 ^{33.06}	1.17	0.28	31.1114	11 41 27
	19	15 28 50.687 ^{9.153}	17 11 27.31 ^{32.99}	1.17	0.28	31.053	11 37 40
	20	15 28 59.840 ^{9.153}	17 12 00.23 ^{32.92}	1.17	0.28	30.964	11 33 53
	21	15 29 08.990 ^{9.150}	-17 12 33.07 ^{32.84}	1.17	0.28	31.30846	11 30 06
	22	15 29 18.135 ^{+9.145}	17 13 05.81 ^{-32.74}	1.17	0.28	30.699	11 26 19
	23	15 29 27.270 ^{9.135}	17 13 38.45 ^{32.64}	1.17	0.28	30.523	11 22 33
	24	15 29 36.394 ^{9.124}	17 14 10.96 ^{32.51}	1.17	0.28	30.319	11 18 46
	25	15 29 45.503 ^{9.109}	17 14 43.34 ^{32.38}	1.17	0.28	30.085	11 14 59
	26	15 29 54.596 ^{9.093}	-17 15 15.56 ^{32.22}	1.17	0.28	31.29823	11 11 12
	27	15 30 03.671 ^{+9.075}	17 15 47.63 ^{-32.07}	1.17	0.28	29.532	11 07 25
	28	15 30 12.728 ^{9.057}	17 16 19.51 ^{31.88}	1.17	0.28	29.212	11 03 38
	29	15 30 21.767 ^{9.039}	17 16 51.23 ^{31.72}	1.17	0.28	28.864	10 59 51
	30	15 30 30.787 ^{9.020}	17 17 22.76 ^{31.53}	1.17	0.28	28.486	10 56 04
	1	15 30 39.788 ^{9.001}	-17 17 54.14 ^{31.38}	1.17	0.28	31.28080	10 52 17
	2	15 30 48.765 ^{+8.977}	17 18 25.35 ^{-31.21}	1.17	0.28	27.646	10 48 30
	3	15 30 57.715 ^{8.950}	17 18 56.40 ^{31.05}	1.17	0.28	27.183	10 44 43
	4	15 31 06.634 ^{8.919}	17 19 27.28 ^{30.88}	1.17	0.28	26.692	10 40 56
	5	15 31 15.516 ^{8.882}	17 19 57.95 ^{30.67}	1.17	0.28	26.173	10 37 09
	6	15 31 24.359 ^{8.843}	-17 20 28.42 ^{30.47}	1.17	0.28	31.25626	10 33 22
	7	15 31 33.160 ^{+8.801}	17 20 58.65 ^{-30.23}	1.17	0.28	25.051	10 29 35
	8	15 31 41.916 ^{8.756}	17 21 28.64 ^{29.99}	1.17	0.28	24.449	10 25 48
	9	15 31 50.628 ^{8.712}	17 21 58.38 ^{29.74}	1.17	0.28	23.819	10 22 00
	10	15 31 59.294 ^{8.666}	17 22 27.85 ^{29.47}	1.17	0.28	23.163	10 18 13
	11	15 32 07.913 ^{8.619}	-17 22 57.06 ^{29.21}	1.17	0.28	31.22479	10 14 26
	12	15 32 16.484 ^{+8.571}	17 23 26.01 ^{-28.95}	1.17	0.28	21.768	10 10 38
	13	15 32 25.007 ^{8.523}	17 23 54.70 ^{28.69}	1.17	0.28	21.031	10 06 51
	14	15 32 33.480 ^{8.473}	17 24 23.12 ^{28.42}	1.17	0.28	20.267	10 03 03
	15	15 32 41.901 ^{8.421}	17 24 51.28 ^{28.16}	1.17	0.28	19.478	9 59 16
	16	15 32 50.269 ^{8.368}	-17 25 19.19 ^{27.91}	1.17	0.28	31.18662	9 55 28
	17	15 32 58.579 ^{+8.310}	17 25 46.82 ^{-27.63}	1.17	0.28	17.821	9 51 40
	18	15 33 06.831 ^{8.252}	17 26 14.18 ^{27.36}	1.17	0.28	16.954	9 47 53
	19	15 33 15.020 ^{8.189}	17 26 41.27 ^{27.09}	1.17	0.28	16.062	9 44 05
	20	15 33 23.144 ^{8.124}	17 27 08.07 ^{26.80}	1.17	0.28	15.145	9 40 17
	21	15 33 31.199 ^{8.055}	-17 27 34.56 ^{26.49}	1.17	0.28	31.14203	9 36 29
	22	15 33 39.184 ^{+7.985}	17 28 00.74 ^{-26.18}	1.17	0.28	13.236	9 32 41
	23	15 33 47.096 ^{7.912}	17 28 26.59 ^{25.85}	1.17	0.28	12.245	9 28 53
	24	15 33 54.935 ^{7.839}	17 28 52.09 ^{25.50}	1.18	0.28	11.230	9 25 05
	25	15 34 02.699 ^{7.764}	17 29 17.25 ^{25.16}	1.18	0.28	10.191	9 21 17
	26	15 34 10.389 ^{7.690}	-17 29 42.05 ^{24.80}	1.18	0.28	31.09129	9 17 28
	27	15 34 18.004 ^{+7.615}	17 30 06.50 ^{-24.45}	1.18	0.28	08.043	9 13 40
	28	15 34 25.543 ^{7.539}	17 30 30.62 ^{24.12}	1.18	0.28	06.934	9 09 52
	29	15 34 33.006 ^{7.463}	17 30 54.40 ^{23.78}	1.18	0.28	05.802	9 06 03
	30	15 34 40.388 ^{7.382}	17 31 17.84 ^{23.44}	1.18	0.28	04.648	9 02 15
	31	15 34 47.685 ^{7.297}	-17 31 40.95 ^{23.11}	1.18	0.28	31.03472	8 58 26
	32	15 34 54.893 ^{+7.208}	17 32 03.71 ^{-22.76}	1.18	0.28	31.02274	8 54 37

PLUTO, 1967
FOR 0^h EPHEMERIS TIME

Date	Astrometric Right Ascension 1950.0	Astrometric Declination 1950.0	Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	^h ^m ^s	[°] ['] ["]	["]		^h ^m
Jan. -2	11 49 08.473 - 0.173	+17 30 07.15 +135.78	0.28	31.98965 -6602	5 21
2	11 49 08.300 2.149	17 32 22.93 +146.00	.28	.92363 6440	5 05
6	11 49 06.151 4.109	17 34 48.93 155.46	.28	.85923 6244	4 50
10	11 49 02.042 6.031	17 37 24.39 164.04	.28	.79679 6017	4 34
14	11 48 56.011 7.901	17 40 08.43 171.59	.28	.73662 5758	4 18
18	11 48 48.110 - 9.704	+17 43 00.02 +178.11	0.28	31.67904 -5470	4 02
22	11 48 38.406 11.430	17 45 58.13 183.56	.28	.62434 5158	3 46
26	11 48 26.976 13.077	17 49 01.69 187.99	.28	.57276 4822	3 30
30	11 48 13.899 14.642	17 52 09.68 191.35	.28	.52454 4463	3 14
Feb. 3	11 47 59.257 16.115	17 55 21.03 193.62	.28	.47991 4082	2 58
7	11 47 43.142 -17.477	+17 58 34.65 +194.70	0.28	31.43909 -3679	2 42
11	11 47 25.665 18.716	18 01 49.35 194.55	.28	.40230 3257	2 26
15	11 47 06.949 19.821	18 05 03.90 193.17	.28	.36973 2821	2 10
19	11 46 47.128 20.788	18 08 17.07 190.61	.28	.34152 2374	1 54
23	11 46 26.340 21.620	18 11 27.68 186.97	.28	.31778 1920	1 38
27	11 46 04.720 -22.317	+18 14 34.65 +182.28	0.28	31.29858 -1457	1 22
Mar. 3	11 45 42.403 22.874	18 17 36.93 176.54	.28	.28401 988	1 06
7	11 45 19.529 23.279	18 20 33.47 169.70	.28	.27413 514	0 50
11	11 44 56.250 23.524	18 23 23.17 161.80	.28	.26899 - 40	0 34
15	11 44 32.726 23.609	18 26 04.97 152.92	.28	.26859 + 432	0 18
19	11 44 09.117 -23.538	+18 28 37.89 +143.16	0.28	31.27291 + 895	0 02
23	11 43 45.579 23.318	18 31 01.05 132.63	.28	.28186 1351	23 41
27	11 43 22.261 22.960	18 33 13.68 121.45	.28	.29537 1797	23 25
31	11 42 59.301 22.462	18 35 15.13 109.61	.28	.31334 2232	23 09
Apr. 4	11 42 36.839 21.819	18 37 04.74 97.12	.28	.33566 2655	22 53
8	11 42 15.020 -21.033	+18 38 41.86 + 84.05	0.28	31.36221 +3064	22 37
12	11 41 53.987 20.110	18 40 05.91 70.53	.28	.39285 3453	22 21
16	11 41 33.877 19.058	18 41 16.44 56.64	.28	.42738 3820	22 05
20	11 41 14.819 17.896	18 42 13.08 42.56	.28	.46558 4164	21 49
24	11 40 56.923 16.636	18 42 55.64 28.35	.28	.50722 4487	21 33
28	11 40 40.287 -15.279	+18 43 23.99 + 14.02	0.28	31.55209 +4787	21 17
May 2	11 40 25.008 13.826	18 43 38.01 - 0.40	.28	.59996 5064	21 01
6	11 40 11.182 12.281	18 43 37.61 14.86	.28	.65060 5315	20 45
10	11 39 58.901 10.657	18 43 22.75 29.24	.28	.70375 5537	20 29
14	11 39 48.244 8.966	18 42 53.51 43.43	.28	.75912 5730	20 13
18	11 39 39.278 - 7.226	+18 42 10.08 - 57.33	0.28	31.81642 +5893	19 57
22	11 39 32.052 5.450	18 41 12.75 70.87	.28	.87535 6027	19 41
26	11 39 26.602 3.640	18 40 01.88 84.07	.28	.93562 6135	19 26
30	11 39 22.962 - 1.797	18 38 37.81 96.95	.28	31.99697 6216	19 10
June 3	11 39 21.165 + 0.074	18 37 00.86 109.42	.27	32.05913 6265	18 54
7	11 39 21.239 + 1.960	+18 35 11.44 -121.43	0.27	32.12178 +6286	18 38
11	11 39 23.199 3.849	18 33 10.01 132.88	.27	.18464 6274	18 23
15	11 39 27.048 5.721	18 30 57.13 143.68	.27	.24738 6233	18 07
19	11 39 32.769 7.572	18 28 33.45 153.82	.27	.30971 6165	17 51
23	11 39 40.341 9.398	18 25 59.63 163.36	.27	.37136 6070	17 36
27	11 39 49.739 +11.203	+18 23 16.27 -172.29	0.27	32.43206 +5950	17 20
July 1	11 40 00.942	+18 20 23.98	0.27	32.49156	17 05

Double transit, March 19

PLUTO, 1967
FOR 0^h EPHEMERIS TIME

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Date	Astrometric Right Ascension 1950.0			Astrometric Declination 1950.0			Hor. Par.	True Distance from the Earth	Ephem- eris Transit
	h	m	s	°	'	"	"		h m
July 1	11	40	00.942	+18	20	23.98	0.27	32.49156	17 05
5	11	40	13.918	18	17	23.38	.27	.54959	16 49
9	11	40	28.632	18	14	15.18	.27	.60588	16 34
13	11	40	45.031	18	11	00.14	.27	.66014	16 18
17	11	41	03.052	18	07	39.09	.27	.71214	16 03
21	11	41	22.627	+18	04	12.82	0.27	32.76166	15 48
25	11	41	43.688	18	00	42.07	.27	.80850	15 32
29	11	42	06.171	17	57	07.55	.27	.85247	15 17
Aug. 2	11	42	30.007	17	53	30.01	.27	.89335	15 01
6	11	42	55.121	17	49	50.25	.27	.93095	14 46
10	11	43	21.425	+17	46	09.10	0.27	32.96508	14 31
14	11	43	48.820	17	42	27.45	.27	32.99557	14 16
18	11	44	17.209	17	38	46.13	.27	33.02231	14 00
22	11	44	46.497	17	35	05.90	.27	.04518	13 45
26	11	45	16.593	17	31	27.51	.27	.06407	13 30
30	11	45	47.403	+17	27	51.71	0.27	33.07889	13 15
Sept. 3	11	46	18.826	17	24	19.29	.27	.08953	12 59
7	11	46	50.751	17	20	51.09	.27	.09590	12 44
11	11	47	23.062	17	17	27.97	.27	.09797	12 29
15	11	47	55.642	17	14	10.69	.27	.09571	12 14
19	11	48	28.384	+17	10	59.97	0.27	33.08914	11 59
23	11	49	01.182	17	07	56.46	.27	.07827	11 44
27	11	49	33.928	17	05	00.86	.27	.06310	11 28
Oct. 1	11	50	06.510	17	02	13.86	.27	.04365	11 13
5	11	50	38.810	16	59	36.19	.27	33.01998	10 58
9	11	51	10.703	+16	57	08.58	0.27	32.99216	10 43
13	11	51	42.070	16	54	51.63	.27	.96031	10 28
17	11	52	12.801	16	52	45.87	.27	.92456	10 12
21	11	52	42.791	16	50	51.78	.27	.88505	9 57
25	11	53	11.937	16	49	09.85	.27	.84192	9 42
29	11	53	40.129	+16	47	40.55	0.27	32.79531	9 27
Nov. 2	11	54	07.257	16	46	24.35	.27	.74541	9 11
6	11	54	33.207	16	45	21.69	.27	.69241	8 56
10	11	54	57.875	16	44	32.88	.27	.63658	8 41
14	11	55	21.172	16	43	58.11	.27	.57815	8 25
18	11	55	43.013	+16	43	37.50	0.27	32.51738	8 10
22	11	56	03.317	16	43	31.18	.27	.45452	7 55
26	11	56	22.004	16	43	39.23	.27	.38982	7 39
30	11	56	38.993	16	44	01.70	.27	.32358	7 24
Dec. 4	11	56	54.207	16	44	38.59	.27	.25610	7 08
8	11	57	07.583	+16	45	29.70	0.27	32.18771	6 53
12	11	57	19.076	16	46	34.75	.27	.11874	6 37
16	11	57	28.650	16	47	53.37	.27	32.04952	6 22
20	11	57	36.275	16	49	25.15	.28	31.98035	6 06
24	11	57	41.925	16	51	09.66	.28	.91156	5 50
28	11	57	45.576	+16	53	06.43	0.28	31.84345	5 35
32	11	57	47.216	+16	55	14.89	0.28	31.77638	5 19

CERES, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension				Declination				Hor. Par.	True Distance	Ephem- eris Transit					
	Astrometric 1950.0		App. -Astr.		Astrometric 1950.0		App. -Astr.									
	h	m	s		m	s		°	'	"		h	m	s		
Jan. 0	5	50	05.02	-	61.11	+1 04.35		+26	45	37.0	+207.9	+0	20.5	5.27	1.670 813	23 10 29
1	5	49	03.91	-	60.47	04.38		26	49	04.9	203.7	0	22.1	5.26	.672 849	23 05 33
2*	5	48	03.44	-	59.74	04.41		26	52	28.6	199.6	0	23.7	5.25	.675 167	23 00 38
3	5	47	03.70	-	58.96	04.43		26	55	48.2	195.5	0	25.2	5.25	.677 768	22 55 43
4	5	46	04.74	-	58.08	04.46		26	59	03.7	191.4	0	26.7	5.24	.680 648	22 50 49
5	5	45	06.66	-	57.14	+1 04.48		+27	02	15.1	+187.2	+0	28.2	5.23	1.683 807	22 45 57
6	5	44	09.52	-	56.13	04.50		27	05	22.3	183.2	0	29.6	5.22	.687 241	22 41 05
7	5	43	13.39	-	55.04	04.53		27	08	25.5	179.1	0	31.0	5.20	.690 948	22 36 14
8	5	42	18.35	-	53.89	04.56		27	11	24.6	175.1	0	32.4	5.19	.694 926	22 31 25
9	5	41	24.46	-	52.67	04.59		27	14	19.7	171.3	0	33.8	5.18	.699 171	22 26 36
10	5	40	31.79	-	51.39	+1 04.62		+27	17	11.0	+167.3	+0	35.2	5.17	1.703 680	22 21 49
11	5	39	40.40	-	50.04	04.65		27	19	58.3	163.6	0	36.5	5.15	.708 449	22 17 04
12	5	38	50.36	-	48.64	04.67		27	22	41.9	159.8	0	37.9	5.14	.713 476	22 12 19
13	5	38	01.72	-	47.18	04.69		27	25	21.7	156.3	0	39.2	5.12	.718 755	22 07 36
14	5	37	14.54	-	45.68	04.70		27	27	58.0	152.7	0	40.4	5.10	.724 283	22 02 55
15*	5	36	28.86	-	44.12	+1 04.71		+27	30	30.7	+149.3	+0	41.7	5.09	1.730 056	21 58 15
16	5	35	44.74	-	42.52	04.72		27	33	00.0	146.1	0	42.8	5.07	.736 068	21 53 37
17	5	35	02.22	-	40.89	04.72		27	35	26.1	142.7	0	43.9	5.05	.742 317	21 49 00
18	5	34	21.33	-	39.20	04.73		27	37	48.8	139.7	0	45.0	5.03	.748 796	21 44 25
19	5	33	42.13	-	37.49	04.73		27	40	08.5	136.7	0	46.0	5.01	.755 503	21 39 52
20	5	33	04.64	-	35.74	+1 04.74		+27	42	25.2	+133.8	+0	46.9	4.99	1.762 431	21 35 20
21	5	32	28.90	-	33.98	04.75		27	44	39.0	131.0	0	47.8	4.97	.769 577	21 30 50
22	5	31	54.92	-	32.17	04.76		27	46	50.0	128.4	0	48.7	4.95	.776 935	21 26 22
23	5	31	22.75	-	30.35	04.77		27	48	58.4	125.8	0	49.5	4.93	.784 501	21 21 56
24	5	30	52.40	-	28.51	04.79		27	51	04.2	123.3	0	50.3	4.91	.792 270	21 17 31
25	5	30	23.89	-	26.66	+1 04.80		+27	53	07.5	+121.0	+0	51.1	4.89	1.800 238	21 13 09
26	5	29	57.23	-	24.78	04.82		27	55	08.5	118.7	0	51.8	4.87	.808 400	21 08 48
27	5	29	32.45	-	22.89	04.83		27	57	07.2	116.6	0	52.6	4.84	.816 752	21 04 29
28	5	29	09.56	-	21.00	04.83		27	59	03.8	114.5	0	53.2	4.82	.825 288	21 00 12
29*	5	28	48.56	-	19.10	04.83		28	00	58.3	112.6	0	53.8	4.80	.834 006	20 55 57
30	5	28	29.46	-	17.17	+1 04.83		+28	02	50.9	+110.7	+0	54.4	4.78	1.842 900	20 51 44
31	5	28	12.29	-	15.25	04.82		28	04	41.6	109.0	0	54.8	4.75	.851 967	20 47 33
Feb. 1	5	27	57.04	-	13.32	04.82		28	06	30.6	107.3	0	55.2	4.73	.861 201	20 43 23
2	5	27	43.72	-	11.38	04.82		28	08	17.9	105.7	0	55.6	4.70	.870 600	20 39 16
3	5	27	32.34	-	9.44	04.83		28	10	03.6	104.2	0	55.8	4.68	.880 158	20 35 10
4	5	27	22.90	-	7.49	+1 04.84		+28	11	47.8	+102.8	+0	56.1	4.66	1.889 871	20 31 06
5	5	27	15.41	-	5.55	04.85		28	13	30.6	101.5	0	56.3	4.63	.899 735	20 27 05
6	5	27	09.86	-	3.60	04.86		28	15	12.1	100.2	0	56.5	4.61	.909 744	20 23 05
7	5	27	06.26	-	1.66	04.86		28	16	52.3	99.0	0	56.6	4.58	.919 895	20 19 07
8	5	27	04.60	+	0.29	04.87		28	18	31.3	97.9	0	56.7	4.56	.930 183	20 15 11
9	5	27	04.89	+	2.21	+1 04.87		+28	20	09.2	+96.8	+0	56.8	4.54	1.940 602	20 11 17
10	5	27	07.10	+	4.14	04.87		28	21	46.0	95.8	0	56.8	4.51	.951 148	20 07 25
11*	5	27	11.24	+	6.06	04.87		28	23	21.8	94.8	0	56.8	4.49	.961 817	20 03 35
12	5	27	17.30	+	7.96	04.87		28	24	56.6	93.8	0	56.7	4.46	.972 604	19 59 47
13	5	27	25.26	+	9.85	04.86		28	26	30.4	93.0	0	56.6	4.44	.983 504	19 56 00
14	5	27	35.11	+	11.73	+1 04.85		+28	28	03.4	+92.0	+0	56.3	4.41	1.994 513	19 52 16
15	5	27	46.84	+		+1 04.85		+28	29	35.4		+0	56.1	4.39	2.005 625	19 48 33

Photographic Magnitude : Jan. 10, 7.3 ; Jan. 30, 7.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Feb. 15	^{h m s} 5 27 46.84 + ^s	^{m s} +1 04.85	^{° ' "} +28 29 35.4 + ["]	^{' "} +0 56.1	4.39	2.005 625	^{h m s} 19 48 33
16	5 28 00.43 + ^s 13.59	04.85	28 31 06.6 + ["] 91.2	0 55.7	4.36	.016 837	19 44 52
17	5 28 15.87 + ^s 15.44	04.85	28 32 37.0 + ["] 90.4	0 55.3	4.34	.028 145	19 41 13
18	5 28 33.13 + ^s 17.26	04.85	28 34 06.6 + ["] 89.6	0 54.9	4.32	.039 543	19 37 36
19	5 28 52.21 + ^s 19.08	04.86	28 35 35.3 + ["] 88.7	0 54.4	4.29	.051 028	19 34 00
	20.86		87.9				
20	5 29 13.07 + ^s 22.64	+1 04.86	+28 37 03.2 + ["] 87.1	+0 53.9	4.27	2.062 596	19 30 27
21	5 29 35.71 + ^s 24.38	04.87	28 38 30.3 + ["] 86.2	0 53.4	4.24	.074 243	19 26 55
22	5 30 00.09 + ^s 26.11	04.88	28 39 56.5 + ["] 85.5	0 52.9	4.22	.085 965	19 23 24
23	5 30 26.20 + ^s 27.81	04.89	28 41 22.0 + ["] 84.5	0 52.3	4.20	.097 757	19 19 56
24	5 30 54.01 + ^s 29.50	04.89	28 42 46.5 + ["] 83.7	0 51.7	4.17	.109 618	19 16 29
25*	5 31 23.51 + ^s 31.16	+1 04.89	+28 44 10.2 + ["] 82.8	+0 51.1	4.15	2.121 543	19 13 04
26	5 31 54.67 + ^s 32.81	04.89	28 45 33.0 + ["] 81.9	0 50.3	4.13	.133 530	19 09 40
27	5 32 27.48 + ^s 34.43	04.88	28 46 54.9 + ["] 81.0	0 49.6	4.10	.145 575	19 06 18
28	5 33 01.91 + ^s 36.03	04.88	28 48 15.9 + ["] 80.0	0 48.7	4.08	.157 675	19 02 58
Mar. 1	5 33 37.94 + ^s 37.62	04.88	28 49 35.9 + ["] 78.9	0 47.8	4.06	.169 827	18 59 39
2	5 34 15.56 + ^s 39.18	+1 04.88	+28 50 54.8 + ["] 78.0	+0 46.8	4.03	2.182 029	18 56 22
3	5 34 54.74 + ^s 40.74	04.89	28 52 12.8 + ["] 76.9	0 45.8	4.01	.194 277	18 53 06
4	5 35 35.48 + ^s 42.27	04.90	28 53 29.7 + ["] 75.8	0 44.8	3.99	.206 568	18 49 52
5	5 36 17.75 + ^s 43.78	04.90	28 54 45.5 + ["] 74.7	0 43.8	3.97	.218 898	18 46 39
6	5 37 01.53 + ^s 45.27	04.91	28 56 00.2 + ["] 73.5	0 42.8	3.94	.231 266	18 43 28
7	5 37 46.80 + ^s 46.75	+1 04.92	+28 57 13.7 + ["] 72.3	+0 41.7	3.92	2.243 667	18 40 18
8	5 38 33.55 + ^s 48.21	04.92	28 58 26.0 + ["] 71.1	0 40.6	3.90	.256 098	18 37 10
9	5 39 21.76 + ^s 49.63	04.92	28 59 37.1 + ["] 69.7	0 39.5	3.88	.268 556	18 34 03
10	5 40 11.39 + ^s 51.06	04.92	29 00 46.8 + ["] 68.4	0 38.3	3.86	.281 038	18 30 58
11*	5 41 02.45 + ^s 52.44	04.92	29 01 55.2 + ["] 67.0	0 37.1	3.84	.293 542	18 27 54
12	5 41 54.89 + ^s 53.82	+1 04.91	+29 03 02.2 + ["] 65.5	+0 35.8	3.82	2.306 062	18 24 51
13	5 42 48.71 + ^s 55.17	04.90	29 04 07.7 + ["] 64.0	0 34.5	3.80	.318 598	18 21 50
14	5 43 43.88 + ^s 56.50	04.89	29 05 11.7 + ["] 62.4	0 33.1	3.78	.331 146	18 18 50
15	5 44 40.38 + ^s 57.80	04.89	29 06 14.1 + ["] 60.8	0 31.7	3.76	.343 702	18 15 51
16	5 45 38.18 + ^s 59.10	04.89	29 07 14.9 + ["] 59.1	0 30.2	3.74	.356 264	18 12 54
17	5 46 37.28 + ^s 60.35	+1 04.89	+29 08 14.0 + ["] 57.3	+0 28.7	3.72	2.368 830	18 09 57
18	5 47 37.63 + ^s 61.60	04.89	29 09 11.3 + ["] 55.5	0 27.2	3.70	.381 396	18 07 03
19	5 48 39.23 + ^s 62.81	04.90	29 10 06.8 + ["] 53.6	0 25.7	3.68	.393 961	18 04 09
20	5 49 42.04 + ^s 64.02	04.90	29 11 00.4 + ["] 51.7	0 24.1	3.66	.406 521	18 01 16
21	5 50 46.06 + ^s 65.18	04.91	29 11 52.1 + ["] 49.6	0 22.5	3.64	.419 074	17 58 25
22	5 51 51.24 + ^s 66.34	+1 04.91	+29 12 41.7 + ["] 47.6	+0 21.0	3.62	2.431 618	17 55 35
23	5 52 57.58 + ^s 67.47	04.91	29 13 29.3 + ["] 45.4	0 19.4	3.60	.444 151	17 52 46
24	5 54 05.05 + ^s 68.58	04.91	29 14 14.7 + ["] 43.2	0 17.8	3.58	.456 670	17 49 58
25*	5 55 13.63 + ^s 69.67	04.90	29 14 57.9 + ["] 41.0	0 16.1	3.56	.469 176	17 47 11
26	5 56 23.30 + ^s 70.75	04.89	29 15 38.9 + ["] 38.6	0 14.4	3.55	.481 664	17 44 25
27	5 57 34.05 + ^s 71.79	+1 04.88	+29 16 17.5 + ["] 36.1	+0 12.7	3.53	2.494 135	17 41 41
28	5 58 45.84 + ^s 72.83	04.87	29 16 53.6 + ["] 33.8	0 10.9	3.51	.506 585	17 38 57
29	5 59 58.67 + ^s 73.85	04.87	29 17 27.4 + ["] 31.1	0 09.0	3.49	.519 015	17 36 14
30	6 01 12.52 + ^s 74.85	04.87	29 17 58.5 + ["] 28.6	0 07.1	3.48	.531 422	17 33 32
31	6 02 27.37 + ^s 75.85	04.87	29 18 27.1 + ["] 26.0	0 05.2	3.46	.543 804	17 30 52
Apr. 1	6 03 43.22 + ^s 76.81	+1 04.87	+29 18 53.1 + ["] 23.2	+0 03.3	3.44	2.556 160	17 28 12
2	6 05 00.03 + ^s	+1 04.87	+29 19 16.3 + ["]	+0 01.4	3.43	2.568 488	17 25 33

Photographic Magnitude : Feb. 19, 7.6 ; Mar. 11, 7.9 ; Mar. 31, 8.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Apr. 1	^{h m s} 6 03 43.22 + ^s 76.81	^{m s} +1 04.87	^{° ' "} +29 18 53.1 + ["] 23.2	["] +0 03.3	3.44	2.556 160	^{h m s} 17 28 12
	6 05 00.03 + 77.77	04.87	29 19 16.3 + 20.4	+0 01.4	3.43	.568 488	17 25 33
	6 06 17.80 + 78.71	04.87	29 19 36.7 + 17.6	-0 00.5	3.41	.580 786	17 22 56
	6 07 36.51 + 79.64	04.86	29 19 54.3 + 14.7	0 02.4	3.39	.593 052	17 20 19
	6 08 56.15 + 80.55	04.85	29 20 09.0 + 11.7	0 04.3	3.38	.605 285	17 17 43
	6 10 16.70 + 81.44	+1 04.84	+29 20 20.7 + 8.7	-0 06.3	3.36	2.617 482	17 15 08
	6 11 38.14 + 82.32	04.82	29 20 29.4 + 5.6	0 08.3	3.35	.629 641	17 12 33
	6 13 00.46 + 83.18	04.81	29 20 35.0 + 2.5	0 10.3	3.33	.641 762	17 10 00
	6 14 23.64 + 84.03	04.79	29 20 37.5 + 0.7	0 12.3	3.32	.653 841	17 07 27
	6 15 47.67 + 84.85	04.77	29 20 36.8 + 4.0	0 14.4	3.30	.665 877	17 04 56
	6 17 12.52 + 85.66	+1 04.75	+29 20 32.8 + 7.3	-0 16.5	3.29	2.677 869	17 02 25
	6 18 38.18 + 86.46	04.73	29 20 25.5 + 10.7	0 18.7	3.27	.689 814	16 59 55
	6 20 04.64 + 87.24	04.71	29 20 14.8 + 14.2	0 20.9	3.26	.701 711	16 57 26
	6 21 31.88 + 88.00	04.70	29 20 00.6 + 17.6	0 23.1	3.24	.713 558	16 54 57
	6 22 59.88 + 88.75	04.69	29 19 43.0 + 21.2	0 25.3	3.23	.725 354	16 52 29
	6 24 28.63 + 89.47	+1 04.68	+29 19 21.8 + 24.8	-0 27.5	3.22	2.737 097	16 50 02
	6 25 58.10 + 90.18	04.67	29 18 57.0 + 28.4	0 29.7	3.20	.748 786	16 47 36
	6 27 28.28 + 90.88	04.66	29 18 28.6 + 32.1	0 31.9	3.19	.760 420	16 45 10
	6 28 59.16 + 91.55	04.64	29 17 56.5 + 35.9	0 34.1	3.18	.771 997	16 42 45
	6 30 30.71 + 92.22	04.62	29 17 20.6 + 39.7	0 36.3	3.16	.783 516	16 40 21
	6 32 02.93 + 92.86	+1 04.59	+29 16 40.9 + 43.6	-0 38.5	3.15	2.794 976	16 37 57
	6 33 35.79 + 93.49	04.56	29 15 57.3 + 47.4	0 40.8	3.14	.806 377	16 35 34
	6 35 09.28 + 94.12	04.53	29 15 09.9 + 51.5	0 43.1	3.12	.817 717	16 33 12
	6 36 43.40 + 94.71	04.50	29 14 18.4 + 55.4	0 45.4	3.11	.828 997	16 30 50
	6 38 18.11 + 95.31	04.47	29 13 23.0 + 59.4	0 47.8	3.10	.840 215	16 28 29
	6 39 53.42 + 95.89	+1 04.45	+29 12 23.6 + 63.5	-0 50.2	3.09	2.851 371	16 26 08
	6 41 29.31 + 96.46	04.43	29 11 20.1 + 67.7	0 52.6	3.07	.862 463	16 23 48
	6 43 05.77 + 97.02	04.41	29 10 12.4 + 71.8	0 55.0	3.06	.873 492	16 21 28
	6 44 42.79 + 97.56	04.39	29 09 00.6 + 76.0	0 57.4	3.05	.884 456	16 19 09
	6 46 20.35 + 98.11	04.36	29 07 44.6 + 80.3	0 59.7	3.04	.895 355	16 16 51
May 1	6 47 58.46 + 98.63	+1 04.34	+29 06 24.3 + 84.5	-1 02.1	3.03	2.906 186	16 14 33
	6 49 37.09 + 99.14	04.30	29 04 59.8 + 88.9	1 04.5	3.02	.916 950	16 12 16
	6 51 16.23 + 99.65	04.27	29 03 30.9 + 93.2	1 06.8	3.01	.927 645	16 09 59
	6 52 55.88 + 100.14	04.23	29 01 57.7 + 97.7	1 09.2	3.00	.938 270	16 07 42
	6 54 36.02 + 100.62	04.19	29 00 20.0 + 102.0	1 11.6	2.98	.948 824	16 05 27
	6 56 16.64 + 101.10	+1 04.14	+28 58 38.0 + 106.6	-1 14.0	2.97	2.959 305	16 03 11
	6 57 57.74 + 101.55	04.09	28 56 51.4 + 111.0	1 16.5	2.96	.969 713	16 00 56
	6 59 39.29 + 101.99	04.05	28 55 00.4 + 115.5	1 19.0	2.95	.980 046	15 58 42
	7 01 21.28 + 102.44	04.00	28 53 04.9 + 120.1	1 21.4	2.94	2.990 304	15 56 27
	7 03 03.72 + 102.85	03.96	28 51 04.8 + 124.7	1 23.9	2.93	3.000 485	15 54 14
	7 04 46.57 + 103.26	+1 03.92	+28 49 00.1 + 129.2	-1 26.5	2.92	3.010 588	15 52 00
	7 06 29.83 + 103.66	03.88	28 46 50.9 + 133.9	1 29.0	2.91	.020 612	15 49 48
	7 08 13.49 + 104.05	03.84	28 44 37.0 + 138.6	1 31.5	2.90	.030 557	15 47 35
	7 09 57.54 + 104.42	03.80	28 42 18.4 + 143.2	1 34.0	2.89	.040 422	15 45 23
	7 11 41.96 + 104.78	03.76	28 39 55.2 + 147.9	1 36.4	2.89	.050 205	15 43 11
	7 13 26.74 + 105.14	+1 03.72	+28 37 27.3 + 152.6	-1 38.9	2.88	3.059 906	15 41 00
	7 15 11.88 + 105.51	+1 03.67	+28 34 54.7 + 157.3	-1 41.3	2.87	3.069 524	15 38 49

Photographic Magnitude : Apr. 20, 8.3 ; May 10, 8.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
May 17	7 15 11.88 ^s	+1 03.67	+28 34 54.7	-1 41.3	2.87	3.069 524	15 38 49
18	7 16 57.34 ^{+105.46}	03.62	28 32 17.4	1 43.8	2.86	.079 059	15 36 38
19	7 18 43.14 ^{105.80}	03.56	28 29 35.3	1 46.2	2.85	.088 511	15 34 28
20	7 20 29.25 ^{106.11}	03.50	28 26 48.5	1 48.7	2.84	.097 878	15 32 18
21*	7 22 15.66 ^{106.41}	03.44	28 23 56.9	1 51.2	2.83	.107 162	15 30 08
	106.71		176.4				
22	7 24 02.37 ^{+106.99}	+1 03.38	+28 21 00.5	-1 53.8	2.82	3.116 361	15 27 58
23	7 25 49.36 ^{107.27}	03.33	28 17 59.4	1 56.3	2.82	.125 476	15 25 49
24	7 27 36.63 ^{107.53}	03.28	28 14 53.4	1 58.9	2.81	.134 506	15 23 40
25	7 29 24.16 ^{107.80}	03.23	28 11 42.7	2 01.4	2.80	.143 451	15 21 31
26	7 31 11.96 ^{108.05}	03.18	28 08 27.1	2 03.9	2.79	.152 311	15 19 23
	108.30		200.5				
27	7 33 00.01 ^{+108.30}	+1 03.13	+28 05 06.6	-2 06.4	2.78	3.161 085	15 17 15
28	7 34 48.31 ^{108.54}	03.07	28 01 41.4	2 08.9	2.78	.169 773	15 15 07
29	7 36 36.85 ^{108.78}	03.02	27 58 11.2	2 11.4	2.77	.178 375	15 12 59
30	7 38 25.63 ^{109.00}	02.95	27 54 36.2	2 13.8	2.76	.186 889	15 10 51
31	7 40 14.63 ^{109.21}	02.89	27 50 56.3	2 16.3	2.75	.195 314	15 08 44
	109.43		224.7				
June 1	7 42 03.84 ^{+109.43}	+1 02.81	+27 47 11.6	-2 18.7	2.75	3.203 651	15 06 37
2	7 43 53.27 ^{109.63}	02.74	27 43 22.0	2 21.2	2.74	.211 899	15 04 30
3	7 45 42.90 ^{109.83}	02.67	27 39 27.5	2 23.6	2.73	.220 056	15 02 23
4*	7 47 32.73 ^{110.01}	02.59	27 35 28.1	2 26.1	2.73	.228 123	15 00 17
5	7 49 22.74 ^{110.19}	02.52	27 31 23.8	2 28.6	2.72	.236 097	14 58 11
	110.37		249.1				
6	7 51 12.93 ^{+110.37}	+1 02.45	+27 27 14.7	-2 31.1	2.71	3.243 980	14 56 04
7	7 53 03.30 ^{110.52}	02.38	27 23 00.7	2 33.6	2.71	.251 769	14 53 58
8	7 54 53.82 ^{110.68}	02.31	27 18 41.8	2 36.1	2.70	.259 464	14 51 53
9	7 56 44.50 ^{+110.83}	02.25	27 14 18.1	2 38.5	2.69	.267 065	14 49 47
10	7 58 35.33 ^{+110.83}	+1 02.18	+27 09 49.5	-2 41.0	2.69	3.274 571	14 47 41
	110.52		268.6				
Nov. 10	12 30 44.08 ^{+95.12}	+0 53.09	+ 5 54 03.4	-5 48.1	2.75	3.198 372	9 16 51
11	12 32 19.20 ^{94.87}	53.09	5 45 22.2	5 47.9	2.76	.189 824	9 14 30
12	12 33 54.07 ^{94.61}	53.10	5 36 44.0	5 47.7	2.77	.181 184	9 12 08
13	12 35 28.68 ^{94.36}	53.10	5 28 09.0	5 47.5	2.77	.172 454	9 09 46
14	12 37 03.04 ^{94.10}	53.11	5 19 37.0	5 47.3	2.78	.163 634	9 07 24
	93.84		508.8				
15	12 38 37.14 ^{+93.84}	+0 53.11	+ 5 11 08.2	-5 47.1	2.79	3.154 724	9 05 02
16	12 40 10.98 ^{+93.84}	+0 53.12	+ 5 02 42.7	-5 46.8	2.80	3.145 726	9 02 39
	93.84		505.5				

Photographic Magnitude : May 30, 8.6 ; June 19, 8.7 ; Nov. 6, 8.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

CERES, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Nov. 16	12 40 10.98 ^s	+0 53.12	+ 5 02 42.7 ^{-502.2}	-5 46.8	2.80	3.145 726	9 02 39
17	12 41 44.55 ^{93.57}	53.13	4 54 20.5 ^{498.8}	5 46.6	2.81	136 640	9 00 16
18	12 43 17.85 ^{93.30}	53.15	4 46 01.7 ^{495.4}	5 46.3	2.81	127 465	8 57 53
19	12 44 50.88 ^{93.03}	53.17	4 37 46.3 ^{491.9}	5 46.1	2.82	118 204	8 55 30
20	12 46 23.63 ^{92.75}	53.19	4 29 34.4 ^{488.3}	5 45.9	2.83	108 856	8 53 06
21*	12 47 56.10 ^{92.47}	+0 53.21	+ 4 21 26.1 ^{-484.7}	-5 45.6	2.84	3.099 421	8 50 42
22	12 49 28.28 ^{91.90}	53.24	4 13 21.4 ^{480.9}	5 45.4	2.85	089 901	8 48 18
23	12 51 00.18 ^{91.59}	53.26	4 05 20.5 ^{477.2}	5 45.1	2.86	080 295	8 45 54
24	12 52 31.77 ^{91.29}	53.28	3 57 23.3 ^{473.3}	5 44.8	2.87	070 605	8 43 29
25	12 54 03.06 ^{90.98}	53.30	3 49 30.0 ^{469.4}	5 44.4	2.88	060 830	8 41 04
26	12 55 34.04 ^{90.67}	+0 53.32	+ 3 41 40.6 ^{-465.4}	-5 44.1	2.88	3.050 971	8 38 38
27	12 57 04.71 ^{90.34}	53.34	3 33 55.2 ^{461.3}	5 43.7	2.89	041 028	8 36 12
28	12 58 35.05 ^{90.01}	53.35	3 26 13.9 ^{457.1}	5 43.3	2.90	031 004	8 33 46
29	13 00 05.06 ^{89.67}	53.37	3 18 36.8 ^{452.8}	5 42.9	2.91	020 897	8 31 20
30	13 01 34.73 ^{89.32}	53.40	3 11 04.0 ^{448.6}	5 42.5	2.92	010 710	8 28 53
Dec. 1	13 03 04.05 ^{88.96}	+0 53.43	+ 3 03 35.4 ^{-444.1}	-5 42.1	2.93	3.000 442	8 26 26
2	13 04 33.01 ^{88.61}	53.46	2 56 11.3 ^{439.6}	5 41.7	2.94	2.990 096	8 23 59
3	13 06 01.62 ^{88.23}	53.50	2 48 51.7 ^{435.0}	5 41.3	2.95	979 673	8 21 31
4*	13 07 29.85 ^{87.85}	53.53	2 41 36.7 ^{430.5}	5 40.9	2.96	969 174	8 19 03
5	13 08 57.70 ^{87.47}	53.57	2 34 26.2 ^{425.8}	5 40.5	2.97	958 601	8 16 34
6	13 10 25.17 ^{87.08}	+0 53.60	+ 2 27 20.4 ^{-421.0}	-5 40.1	2.99	2.947 954	8 14 05
7	13 11 52.25 ^{86.67}	53.63	2 20 19.4 ^{416.3}	5 39.6	3.00	937 235	8 11 36
8	13 13 18.92 ^{86.27}	53.66	2 13 23.1 ^{411.4}	5 39.1	3.01	926 446	8 09 06
9	13 14 45.19 ^{85.86}	53.69	2 06 31.7 ^{406.5}	5 38.6	3.02	915 588	8 06 36
10	13 16 11.05 ^{85.44}	53.71	1 59 45.2 ^{401.6}	5 38.1	3.03	904 661	8 04 06
11	13 17 36.49 ^{85.01}	+0 53.74	+ 1 53 03.6 ^{-396.5}	-5 37.6	3.04	2.893 668	8 01 35
12	13 19 01.50 ^{84.58}	53.77	1 46 27.1 ^{391.5}	5 37.0	3.05	882 609	7 59 03
13	13 20 26.08 ^{84.13}	53.80	1 39 55.6 ^{386.4}	5 36.4	3.07	871 486	7 56 31
14	13 21 50.21 ^{83.69}	53.83	1 33 29.2 ^{381.2}	5 35.9	3.08	860 298	7 53 59
15	13 23 13.90 ^{83.23}	53.87	1 27 08.0 ^{376.0}	5 35.3	3.09	849 049	7 51 26
16	13 24 37.13 ^{82.76}	+0 53.91	+ 1 20 52.0 ^{-370.7}	-5 34.8	3.10	2.837 738	7 48 53
17	13 25 59.89 ^{82.29}	53.95	1 14 41.3 ^{365.4}	5 34.3	3.11	826 366	7 46 20
18	13 27 22.18 ^{81.81}	53.99	1 08 35.9 ^{359.9}	5 33.7	3.13	814 935	7 43 45
19*	13 28 43.99 ^{81.31}	54.03	1 02 36.0 ^{354.5}	5 33.2	3.14	803 446	7 41 11
20	13 30 05.30 ^{80.82}	54.07	0 56 41.5 ^{349.0}	5 32.6	3.15	791 900	7 38 36
21	13 31 26.12 ^{80.30}	+0 54.11	+ 0 50 52.5 ^{-343.4}	-5 32.1	3.17	2.780 297	7 36 00
22	13 32 46.42 ^{79.77}	54.15	0 45 09.1 ^{337.7}	5 31.5	3.18	768 638	7 33 24
23	13 34 06.19 ^{79.25}	54.18	0 39 31.4 ^{331.9}	5 30.9	3.19	756 926	7 30 47
24	13 35 25.44 ^{78.69}	54.22	0 33 59.5 ^{326.2}	5 30.3	3.21	745 160	7 28 10
25	13 36 44.13 ^{78.14}	54.25	0 28 33.3 ^{320.3}	5 29.6	3.22	733 342	7 25 33
26	13 38 02.27 ^{77.57}	+0 54.28	+ 0 23 13.0 ^{-314.4}	-5 29.0	3.23	2.721 474	7 22 54
27	13 39 19.84 ^{76.98}	54.32	0 17 58.6 ^{308.3}	5 28.3	3.25	709 556	7 20 15
28	13 40 36.82 ^{76.38}	54.36	0 12 50.3 ^{302.2}	5 27.7	3.26	697 590	7 17 36
29	13 41 53.20 ^{75.77}	54.41	0 07 48.1 ^{296.1}	5 27.1	3.28	685 579	7 14 56
30	13 43 08.97 ^{75.14}	54.45	+ 0 02 52.0 ^{289.8}	5 26.5	3.29	673 523	7 12 15
31	13 44 24.11 ^{74.51}	+0 54.50	- 0 01 57.8 ^{-283.6}	-5 25.9	3.31	2.661 425	7 09 34
32*	13 45 38.62 ^{74.51}	+0 54.55	- 0 06 41.4	-5 25.3	3.32	2.649 287	7 06 52

Photographic Magnitude : Nov. 26, 8.5 ; Dec. 16, 8.3 ; Dec. 36, 8.1

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967
FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Jan. 0	^h 0 54 06.78 ^s	^m +0 49.98	[°] -19 28 11.5	['] +5 20.3	3.55	2.480 081	^h 18 16 37
1	0 54 50.19 + 43.41	49.96	19 22 43.0 + 328.5	5 20.1	3.53	.490 485	18 13 25
2	0 55 34.72 44.53	49.93	19 17 07.4 335.6	5 19.8	3.52	.500 854	18 10 14
3	0 56 20.38 45.66	49.90	19 11 24.8 342.6	5 19.5	3.50	.511 186	18 07 04
4	0 57 07.15 46.77	49.87	19 05 35.3 349.5	5 19.1	3.49	.521 479	18 03 56
5	0 57 55.02 + 47.87	+0 49.85	-18 59 39.2 + 356.1	+5 18.8	3.48	2.531 730	18 00 48
6	0 58 43.97 + 48.95	49.82	18 53 36.5 + 362.7	5 18.5	3.46	.541 938	17 57 42
7	0 59 34.00 50.03	49.80	18 47 27.5 369.0	5 18.2	3.45	.552 098	17 54 36
8	1 00 25.09 51.09	49.78	18 41 12.3 375.2	5 17.9	3.43	.562 210	17 51 32
9	1 01 17.23 52.14	49.76	18 34 51.1 381.2	5 17.6	3.42	.572 271	17 48 29
10*	1 02 10.40 53.17	+0 49.74	-18 28 24.1 387.0	+5 17.3	3.41	2.582 278	17 45 26
11	1 03 04.60 + 54.20	49.73	18 21 51.4 + 392.7	5 17.0	3.39	.592 229	17 42 25
12	1 03 59.81 55.21	49.71	18 15 13.2 398.2	5 16.6	3.38	.602 122	17 39 25
13	1 04 56.01 56.20	49.69	18 08 29.7 403.5	5 16.3	3.37	.611 955	17 36 26
14	1 05 53.20 57.19	49.66	18 01 41.0 408.7	5 15.9	3.36	.621 726	17 33 27
15	1 06 51.35 58.15	+0 49.64	-17 54 47.4 413.6	+5 15.5	3.34	2.631 433	17 30 30
16	1 07 50.46 + 59.11	49.61	17 47 48.9 + 418.5	5 15.1	3.33	.641 073	17 27 34
17	1 08 50.51 60.05	49.58	17 40 45.7 423.2	5 14.6	3.32	.650 646	17 24 38
18	1 09 51.49 60.98	49.55	17 33 38.0 427.7	5 14.2	3.31	.660 150	17 21 44
19	1 10 53.38 61.89	49.52	17 26 25.9 432.1	5 13.7	3.30	.669 583	17 18 50
20	1 11 56.17 62.79	+0 49.50	-17 19 09.6 436.3	+5 13.2	3.28	2.678 944	17 15 57
21	1 12 59.85 + 63.68	49.48	17 11 49.1 + 440.5	5 12.8	3.27	.688 231	17 13 05
22	1 14 04.40 64.55	49.46	17 04 24.8 444.3	5 12.3	3.26	.697 444	17 10 14
23	1 15 09.82 65.42	49.44	16 56 56.6 448.2	5 11.9	3.25	.706 580	17 07 24
24*	1 16 16.08 66.26	49.43	16 49 24.8 451.8	5 11.4	3.24	.715 640	17 04 34
25	1 17 23.18 67.10	+0 49.41	-16 41 49.3 455.5	+5 11.0	3.23	2.724 622	17 01 46
26	1 18 31.11 + 67.93	49.40	16 34 10.5 + 458.8	5 10.5	3.22	.733 525	16 58 58
27	1 19 39.86 68.75	49.38	16 26 28.3 462.2	5 10.0	3.21	.742 348	16 56 11
28	1 20 49.41 69.55	49.37	16 18 42.8 465.5	5 09.5	3.20	.751 091	16 53 25
29	1 21 59.76 70.35	49.34	16 10 54.2 468.6	5 08.9	3.19	.759 753	16 50 40
30	1 23 10.89 71.13	+0 49.32	-16 03 02.6 471.6	+5 08.3	3.18	2.768 333	16 47 55
31	1 24 22.81 + 71.92	49.30	15 55 08.1 + 474.5	5 07.7	3.17	.776 830	16 45 11
Feb. 1	1 25 35.50 72.69	49.27	15 47 10.7 477.4	5 07.1	3.16	.785 244	16 42 28
2	1 26 48.95 73.45	49.25	15 39 10.6 480.1	5 06.5	3.15	.793 572	16 39 46
3	1 28 03.16 74.21	49.24	15 31 07.9 482.7	5 05.8	3.14	.801 815	16 37 04
4	1 29 18.12 74.96	+0 49.22	-15 23 02.6 485.3	+5 05.2	3.13	2.809 970	16 34 24
5	1 30 33.82 + 75.70	49.21	15 14 55.0 + 487.6	5 04.6	3.12	.818 038	16 31 44
6	1 31 50.25 76.43	49.20	15 06 45.0 490.0	5 04.0	3.11	.826 016	16 29 04
7*	1 33 07.41 77.16	49.19	14 58 32.9 492.1	5 03.3	3.11	.833 904	16 26 26
8	1 34 25.28 77.87	49.18	14 50 18.6 494.3	5 02.7	3.10	.841 701	16 23 48
9	1 35 43.86 78.58	+0 49.17	-14 42 02.4 496.2	+5 02.0	3.09	2.849 406	16 21 10
10	1 37 03.14 + 79.28	49.16	14 33 44.4 + 498.0	5 01.3	3.08	.857 018	16 18 34
11	1 38 23.11 79.97	49.14	14 25 24.6 499.8	5 00.5	3.07	.864 535	16 15 58
12	1 39 43.77 80.66	49.12	14 17 03.2 501.4	4 59.7	3.06	.871 958	16 13 23
13	1 41 05.09 81.32	49.10	14 08 40.3 502.9	4 58.9	3.06	.879 286	16 10 48
14	1 42 27.08 81.99	+0 49.09	-14 00 16.0 504.3	+4 58.1	3.05	2.886 518	16 08 14
15	1 43 49.72 + 82.64	+0 49.07	-13 51 50.4 + 505.6	+4 57.3	3.04	2.893 653	16 05 41

Photographic Magnitude : Jan. 10, 9.2 ; Jan. 30, 9.3

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Feb. 15	1 43 49.72 + 83.30	+0 49.07	-13 51 50.4 + 506.8	+4 57.3	3.04	2.893 653	16 05 41
16	1 45 13.02 + 83.93	49.06	13 43 23.6 + 507.8	4 56.4	3.03	.900 692	16 03 09
17	1 46 36.95 + 84.56	49.04	13 34 55.8 + 508.9	4 55.5	3.03	.907 633	16 00 37
18	1 48 01.51 + 85.18	49.04	13 26 26.9 + 509.7	4 54.7	3.02	.914 477	15 58 05
19	1 49 26.69 + 85.80	49.03	13 17 57.2 + 510.6	4 53.8	3.01	.921 224	15 55 35
20	1 50 52.49 + 86.40	+0 49.03	-13 09 26.6 + 511.2	+4 52.9	3.01	2.927 872	15 53 05
21	1 52 18.89 + 87.01	49.03	13 00 55.4 + 511.9	4 52.1	3.00	.934 423	15 50 35
22*	1 53 45.90 + 87.60	49.03	12 52 23.5 + 512.3	4 51.2	2.99	.940 877	15 48 06
23	1 55 13.50 + 88.18	49.03	12 43 51.2 + 512.9	4 50.3	2.99	.947 232	15 45 38
24	1 56 41.68 + 88.77	49.02	12 35 18.3 + 513.2	4 49.4	2.98	.953 491	15 43 10
25	1 58 10.45 + 89.34	+0 49.01	-12 26 45.1 + 513.5	+4 48.4	2.97	2.959 652	15 40 43
26	1 59 39.79 + 89.91	49.01	12 18 11.6 + 513.8	4 47.4	2.97	.965 716	15 38 16
27	2 01 09.70 + 90.49	49.00	12 09 37.8 + 513.9	4 46.4	2.96	.971 684	15 35 50
28	2 02 40.19 + 91.04	48.99	12 01 03.9 + 514.1	4 45.3	2.96	.977 555	15 33 25
Mar. 1	2 04 11.23 + 91.61	48.98	11 52 29.8 + 514.0	4 44.2	2.95	.983 329	15 31 00
2	2 05 42.84 + 92.17	+0 48.98	-11 43 55.8 + 514.0	+4 43.1	2.94	2.989 006	15 28 36
3	2 07 15.01 + 92.71	48.98	11 35 21.8 + 513.9	4 42.0	2.94	2.994 585	15 26 12
4	2 08 47.72 + 93.27	48.98	11 26 47.9 + 513.6	4 40.9	2.93	3.000 068	15 23 49
5	2 10 20.99 + 93.81	48.99	11 18 14.3 + 513.3	4 39.8	2.93	.005 453	15 21 26
6	2 11 54.80 + 94.36	49.00	11 09 41.0 + 512.9	4 38.7	2.92	.010 740	15 19 04
7*	2 13 29.16 + 94.89	+0 49.00	-11 01 08.1 + 512.4	+4 37.6	2.92	3.015 929	15 16 42
8	2 15 04.05 + 95.42	49.01	10 52 35.7 + 511.9	4 36.4	2.91	.021 019	15 14 21
9	2 16 39.47 + 95.94	49.01	10 44 03.8 + 511.1	4 35.2	2.91	.026 012	15 12 00
10	2 18 15.41 + 96.47	49.01	10 35 32.7 + 510.4	4 34.0	2.90	.030 906	15 09 40
11	2 19 51.88 + 96.98	49.01	10 27 02.3 + 509.6	4 32.7	2.90	.035 701	15 07 21
12	2 21 28.86 + 97.50	+0 49.01	-10 18 32.7 + 508.5	+4 31.4	2.89	3.040 398	15 05 02
13	2 23 06.36 + 98.00	49.01	10 10 04.2 + 507.6	4 30.1	2.89	.044 997	15 02 43
14	2 24 44.36 + 98.50	49.01	10 01 36.6 + 506.4	4 28.8	2.89	.049 497	15 00 25
15	2 26 22.86 + 98.99	49.01	9 53 10.2 + 505.1	4 27.4	2.88	.053 900	14 58 08
16	2 28 01.85 + 99.49	49.01	9 44 45.1 + 503.9	4 26.0	2.88	.058 204	14 55 51
17	2 29 41.34 + 99.97	+0 49.02	-9 36 21.2 + 502.5	+4 24.6	2.87	3.062 412	14 53 34
18	2 31 21.31 + 100.44	49.03	9 27 58.7 + 501.0	4 23.2	2.87	.066 522	14 51 18
19	2 33 01.75 + 100.93	49.05	9 19 37.7 + 499.5	4 21.8	2.87	.070 536	14 49 03
20	2 34 42.68 + 101.39	49.06	9 11 18.2 + 497.8	4 20.4	2.86	.074 453	14 46 47
21	2 36 24.07 + 101.77	+0 49.08	-9 03 00.4 + 497.8	+4 19.0	2.86	3.078 276	14 44 33
Sept. 25	9 03 23.43 + 118.47	+0 51.12	-6 38 20.5 + 429.5	-3 57.4	3.26	2.698 718	8 51 01
26	9 05 21.90 + 118.13	51.12	6 45 30.0 + 431.3	3 59.6	3.27	.692 248	8 49 03
27	9 07 20.03 + 117.81	51.13	6 52 41.3 + 433.0	4 01.8	3.28	.685 718	8 47 04
28	9 09 17.84 + 117.46	51.13	6 59 54.3 + 434.5	4 03.9	3.28	.679 127	8 45 06
29	9 11 15.30 + 117.12	51.13	7 07 08.8 + 436.0	4 06.0	3.29	.672 474	8 43 07
30	9 13 12.42 + 116.77	+0 51.13	-7 14 24.8 + 437.2	-4 08.0	3.30	2.665 761	8 41 07
Oct. 1	9 15 09.19 + 116.77	+0 51.13	-7 21 42.0 + 437.2	-4 10.0	3.31	2.658 984	8 39 08

Photographic Magnitude : Feb. 19, 9.4 ; Mar. 11, 9.4 ; Sept. 27, 8.8

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967
FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Oct. 1	^{h m s} 9 15 09.19 ^s	^{m s} +0 51.13	^{° ' "} - 7 21 42.0	^{' "} -4 10.0	3.31	2.658 984	^{h m s} 8 39 08
2	9 17 05.61 ^{+116.42}	51.13	7 29 00.5 ^{-438.5}	4 12.0	3.32	.652 145	8 37 07
3	9 19 01.66 ^{116.05}	51.12	7 36 20.1 ^{439.6}	4 13.9	3.33	.645 243	8 35 07
4	9 20 57.35 ^{115.69}	51.12	7 43 40.6 ^{440.5}	4 15.9	3.34	.638 278	8 33 06
5	9 22 52.67 ^{115.32}	51.12	7 51 02.0 ^{441.4}	4 17.8	3.34	.631 250	8 31 05
	^{114.94}		^{442.1}				
6*	9 24 47.61 ^{+114.55}	+0 51.12	- 7 58 24.1 ^{-442.7}	-4 19.7	3.35	2.624 158	8 29 03
7	9 26 42.16 ^{114.18}	51.13	8 05 46.8 ^{443.1}	4 21.7	3.36	.617 002	8 27 01
8	9 28 36.34 ^{113.78}	51.14	8 13 09.9 ^{443.4}	4 23.6	3.37	.609 783	8 24 59
9	9 30 30.12 ^{113.40}	51.15	8 20 33.3 ^{443.6}	4 25.5	3.38	.602 501	8 22 56
10	9 32 23.52 ^{112.99}	51.17	8 27 56.9 ^{443.7}	4 27.4	3.39	.595 156	8 20 53
11	9 34 16.51 ^{+112.60}	+0 51.18	- 8 35 20.6 ^{-443.7}	-4 29.3	3.40	2.587 748	8 18 50
12	9 36 09.11 ^{112.21}	51.19	8 42 44.3 ^{443.5}	4 31.0	3.41	.580 277	8 16 46
13	9 38 01.32 ^{111.79}	51.20	8 50 07.8 ^{443.3}	4 32.8	3.42	.572 742	8 14 42
14	9 39 53.11 ^{111.40}	51.21	8 57 31.1 ^{442.9}	4 34.5	3.43	.565 143	8 12 37
15	9 41 44.51 ^{110.98}	51.22	9 04 54.0 ^{442.4}	4 36.2	3.44	.557 481	8 10 32
16	9 43 35.49 ^{+110.57}	+0 51.22	- 9 12 16.4 ^{-441.9}	-4 37.8	3.45	2.549 754	8 08 26
17	9 45 26.06 ^{110.16}	51.23	9 19 38.3 ^{441.1}	4 39.5	3.46	.541 964	8 06 20
18	9 47 16.22 ^{109.73}	51.24	9 26 59.4 ^{440.4}	4 41.1	3.47	.534 108	8 04 14
19	9 49 05.95 ^{109.32}	51.25	9 34 19.8 ^{439.5}	4 42.8	3.48	.526 188	8 02 07
20	9 50 55.27 ^{108.88}	51.26	9 41 39.3 ^{438.4}	4 44.4	3.49	.518 202	8 00 00
21*	9 52 44.15 ^{+108.45}	+0 51.28	- 9 48 57.7 ^{-437.3}	-4 46.0	3.51	2.510 151	7 57 52
22	9 54 32.60 ^{108.02}	51.30	9 56 15.0 ^{436.0}	4 47.6	3.52	.502 034	7 55 44
23	9 56 20.62 ^{107.57}	51.32	10 03 31.0 ^{434.7}	4 49.2	3.53	.493 851	7 53 36
24	9 58 08.19 ^{107.12}	51.34	10 10 45.7 ^{433.2}	4 50.7	3.54	.485 601	7 51 27
25	9 59 55.31 ^{106.66}	51.37	10 17 58.9 ^{431.5}	4 52.3	3.55	.477 284	7 49 18
26	10 01 41.97 ^{+106.20}	+0 51.39	-10 25 10.4 ^{-429.8}	-4 53.8	3.56	2.468 901	7 47 08
27	10 03 28.17 ^{105.74}	51.42	10 32 20.2 ^{427.9}	4 55.2	3.58	.460 449	7 44 57
28	10 05 13.91 ^{105.25}	51.44	10 39 28.1 ^{426.0}	4 56.6	3.59	.451 931	7 42 47
29	10 06 59.16 ^{104.77}	51.46	10 46 34.1 ^{423.7}	4 58.0	3.60	.443 344	7 40 35
30	10 08 43.93 ^{104.28}	51.48	10 53 37.8 ^{421.4}	4 59.4	3.61	.434 690	7 38 24
31	10 10 28.21 ^{+103.77}	+0 51.50	-11 00 39.2 ^{-419.0}	-5 00.7	3.63	2.425 968	7 36 12
Nov. 1	10 12 11.98 ^{103.27}	51.52	11 07 38.2 ^{416.3}	5 02.0	3.64	.417 179	7 33 59
2	10 13 55.25 ^{102.75}	51.55	11 14 34.5 ^{413.5}	5 03.4	3.65	.408 322	7 31 46
3	10 15 38.00 ^{102.22}	51.58	11 21 28.0 ^{410.6}	5 04.7	3.67	.399 399	7 29 32
4*	10 17 20.22 ^{101.70}	51.61	11 28 18.6 ^{407.4}	5 06.1	3.68	.390 409	7 27 18
5	10 19 01.92 ^{+101.15}	+0 51.65	-11 35 06.0 ^{-404.1}	-5 07.4	3.70	2.381 354	7 25 03
6	10 20 43.07 ^{100.61}	51.69	11 41 50.1 ^{400.7}	5 08.7	3.71	.372 234	7 22 48
7	10 22 23.68 ^{100.06}	51.73	11 48 30.8 ^{397.1}	5 10.0	3.72	.363 050	7 20 32
8	10 24 03.74 ^{99.50}	51.77	11 55 07.9 ^{393.3}	5 11.2	3.74	.353 802	7 18 15
9	10 25 43.24 ^{98.95}	51.80	12 01 41.2 ^{389.4}	5 12.4	3.75	.344 490	7 15 58
10	10 27 22.19 ^{+98.37}	+0 51.84	-12 08 10.6 ^{-385.4}	-5 13.6	3.77	2.335 116	7 13 41
11	10 29 00.56 ^{97.80}	51.87	12 14 36.0 ^{381.2}	5 14.7	3.78	.325 679	7 11 23
12	10 30 38.36 ^{97.22}	51.90	12 20 57.2 ^{376.9}	5 15.8	3.80	.316 181	7 09 04
13	10 32 15.58 ^{96.64}	51.93	12 27 14.1 ^{372.4}	5 16.8	3.82	.306 621	7 06 45
14	10 33 52.22 ^{96.03}	51.97	12 33 26.5 ^{367.7}	5 17.9	3.83	.296 999	7 04 25
15	10 35 28.25 ^{+95.44}	+0 52.00	-12 39 34.2 ^{-363.0}	-5 18.9	3.85	2.287 317	7 02 04
16	10 37 03.69	+0 52.04	-12 45 37.2	-5 20.0	3.86	2.277 575	6 59 43

Photographic Magnitude : Oct. 17, 8.7 ; Nov. 6, 8.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

PALLAS, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
Nov. 16	10 37 03.69 + 94.83	+0 52.04	-12 45 37.2 - 358.0	-5 20.0	3.86	2.277 575	6 59 43
17	10 38 38.52 + 94.20	52.08	12 51 35.2 - 353.0	5 21.0	3.88	2.267 772	6 57 22
18*	10 40 12.72 + 93.58	52.12	12 57 28.2 - 347.7	5 22.1	3.90	2.257 910	6 55 00
19	10 41 46.30 + 92.94	52.17	13 03 15.9 - 342.3	5 23.1	3.91	2.247 989	6 52 37
20	10 43 19.24 + 92.29	52.22	13 08 58.2 - 336.7	5 24.1	3.93	2.238 008	6 50 13
21	10 44 51.53 + 91.64	+0 52.27	-13 14 34.9 - 330.9	-5 25.1	3.95	2.227 970	6 47 49
22	10 46 23.17 + 90.96	52.32	13 20 05.8 - 325.1	5 26.1	3.97	2.217 873	6 45 24
23	10 47 54.13 + 90.29	52.37	13 25 30.9 - 318.9	5 27.0	3.99	2.207 718	6 42 59
24	10 49 24.42 + 89.59	52.41	13 30 49.8 - 312.6	5 27.9	4.00	2.197 507	6 40 32
25	10 50 54.01 + 88.88	52.46	13 36 02.4 - 306.2	5 28.8	4.02	2.187 239	6 38 06
26	10 52 22.89 + 88.17	+0 52.50	-13 41 08.6 - 299.4	-5 29.6	4.04	2.176 916	6 35 38
27	10 53 51.06 + 87.43	52.54	13 46 08.0 - 292.5	5 30.4	4.06	2.166 537	6 33 10
28	10 55 18.49 + 86.69	52.59	13 51 00.5 - 285.4	5 31.2	4.08	2.156 105	6 30 41
29	10 56 45.18 + 85.92	52.63	13 55 45.9 - 278.1	5 32.0	4.10	2.145 619	6 28 11
30	10 58 11.10 + 85.15	52.68	14 00 24.0 - 270.4	5 32.9	4.12	2.135 082	6 25 40
Dec. 1	10 59 36.25 + 84.36	+0 52.74	-14 04 54.4 - 262.6	-5 33.7	4.14	2.124 495	6 23 09
2*	11 01 00.61 + 83.55	52.80	14 09 17.0 - 254.5	5 34.5	4.16	2.113 858	6 20 37
3	11 02 24.16 + 82.75	52.86	14 13 31.5 - 246.3	5 35.3	4.18	2.103 174	6 18 04
4	11 03 46.91 + 81.91	52.92	14 17 37.8 - 237.7	5 36.1	4.21	2.092 445	6 15 30
5	11 05 08.82 + 81.08	52.98	14 21 35.5 - 229.0	5 36.9	4.23	2.081 671	6 12 56
6	11 06 29.90 + 80.22	+0 53.04	-14 25 24.5 - 220.0	-5 37.6	4.25	2.070 855	6 10 21
7	11 07 50.12 + 79.36	53.09	14 29 04.5 - 210.8	5 38.3	4.27	2.059 998	6 07 44
8	11 09 09.48 + 78.49	53.14	14 32 35.3 - 201.4	5 39.0	4.29	2.049 102	6 05 07
9	11 10 27.97 + 77.59	53.19	14 35 56.7 - 191.8	5 39.6	4.32	2.038 167	6 02 29
10	11 11 45.56 + 76.69	53.24	14 39 08.5 - 181.9	5 40.2	4.34	2.027 197	5 59 50
11	11 13 02.25 + 75.78	+0 53.29	-14 42 10.4 - 171.8	-5 40.8	4.36	2.016 192	5 57 11
12	11 14 18.03 + 74.85	53.34	14 45 02.2 - 161.4	5 41.4	4.39	2.005 154	5 54 30
13	11 15 32.88 + 73.91	53.39	14 47 43.6 - 150.9	5 42.0	4.41	1.994 084	5 51 48
14	11 16 46.79 + 72.94	53.45	14 50 14.5 - 140.1	5 42.6	4.44	1.982 984	5 49 06
15	11 17 59.73 + 71.97	53.51	14 52 34.6 - 129.0	5 43.2	4.46	1.971 855	5 46 22
16*	11 19 11.70 + 70.98	+0 53.57	-14 54 43.6 - 117.6	-5 43.8	4.49	1.960 700	5 43 38
17	11 20 22.68 + 69.98	53.63	14 56 41.2 - 106.2	5 44.4	4.51	1.949 519	5 40 53
18	11 21 32.66 + 68.95	53.69	14 58 27.4 - 94.2	5 45.0	4.54	1.938 315	5 38 06
19	11 22 41.61 + 67.90	53.75	15 00 01.6 - 82.2	5 45.6	4.57	1.927 089	5 35 19
20	11 23 49.51 + 66.85	53.81	15 01 23.8 - 69.7	5 46.1	4.59	1.915 843	5 32 30
21	11 24 56.36 + 65.77	+0 53.87	-15 02 33.5 - 57.1	-5 46.6	4.62	1.904 578	5 29 41
22	11 26 02.13 + 64.67	53.93	15 03 30.6 - 44.1	5 47.1	4.65	1.893 297	5 26 50
23	11 27 06.80 + 63.54	53.98	15 04 14.7 - 30.8	5 47.6	4.68	1.882 002	5 23 58
24	11 28 10.34 + 62.41	54.03	15 04 45.5 - 17.2	5 48.0	4.70	1.870 694	5 21 05
25	11 29 12.75 + 61.24	54.08	15 05 02.7 - 3.2	5 48.5	4.73	1.859 377	5 18 11
26	11 30 13.99 + 60.06	+0 54.13	-15 05 05.9 - 11.1	-5 48.9	4.76	1.848 052	5 15 16
27	11 31 14.05 + 58.85	54.19	15 04 54.8 - 25.7	5 49.4	4.79	1.836 723	5 12 20
28	11 32 12.90 + 57.62	54.24	15 04 29.1 - 40.7	5 49.8	4.82	1.825 391	5 09 22
29	11 33 10.52 + 56.38	54.31	15 03 48.4 - 56.0	5 50.3	4.85	1.814 060	5 06 23
30*	11 34 06.90 + 55.11	54.37	15 02 52.4 - 71.8	5 50.8	4.88	1.802 733	5 03 23
31	11 35 02.01 + 53.82	+0 54.43	-15 01 40.6 - 87.8	-5 51.3	4.91	1.791 413	5 00 22
32	11 35 55.83 + 52.59	+0 54.50	-15 00 12.8 - 71.8	-5 51.7	4.94	1.780 103	4 57 20

Photographic Magnitude : Nov. 26, 8.4 ; Dec. 16, 8.2 ; Dec. 36, 7.9

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephemeris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Jan. 0	^{h m s} 8 40 32.43 - 34.53	^{m s} +0 52.89	^{° ′ ″} + 0 36 54.9 +147.5	^{′ ″} -3 33.9	6.54	1.346 051	^{h m s} 2 05 09
1	8 39 57.90 - 36.05	52.93	0 39 22.4 +164.7	3 33.4	6.56	.341 908	2 00 38
2	8 39 21.85 - 37.53	52.96	0 42 07.1 +182.0	3 32.8	6.58	.337 961	1 56 06
3	8 38 44.32 - 38.95	53.00	0 45 09.1 +199.4	3 32.3	6.60	.334 215	1 51 33
4	8 38 05.37 - 40.33	53.03	0 48 28.5 +216.8	3 31.7	6.61	.330 673	1 46 58
5*	8 37 25.04 - 41.65	+0 53.07	+ 0 52 05.3 +234.1	-3 31.1	6.63	1.327 341	1 42 22
6	8 36 43.39 - 42.92	53.11	0 55 59.4 +251.5	3 30.5	6.65	.324 222	1 37 45
7	8 36 00.47 - 44.13	53.16	1 00 10.9 +268.6	3 29.9	6.66	.321 321	1 33 06
8	8 35 16.34 - 45.26	53.21	1 04 39.5 +285.8	3 29.3	6.67	.318 642	1 28 27
9	8 34 31.08 - 46.34	53.26	1 09 25.3 +302.7	3 28.6	6.69	.316 189	1 23 46
10	8 33 44.74 - 47.34	+0 53.32	+ 1 14 28.0 +319.4	-3 27.9	6.70	1.313 966	1 19 04
11	8 32 57.40 - 48.27	53.37	1 19 47.4 +336.0	3 27.2	6.71	.311 976	1 14 21
12	8 32 09.13 - 49.12	53.42	1 25 23.4 +352.3	3 26.4	6.72	.310 223	1 09 37
13	8 31 20.01 - 49.90	53.47	1 31 15.7 +368.3	3 25.6	6.72	.308 709	1 04 52
14	8 30 30.11 - 50.60	53.52	1 37 24.0 +384.0	3 24.7	6.73	.307 439	1 00 07
15	8 29 39.51 - 51.22	+0 53.57	+ 1 43 48.0 +399.4	-3 23.8	6.74	1.306 414	0 55 21
16	8 28 48.29 - 51.76	53.62	1 50 27.4 +414.3	3 23.0	6.74	.305 638	0 50 34
17	8 27 56.53 - 52.21	53.67	1 57 21.7 +428.9	3 22.1	6.74	.305 112	0 45 46
18	8 27 04.32 - 52.60	53.72	2 04 30.6 +443.1	3 21.2	6.74	.304 839	0 40 59
19*	8 26 11.72 - 52.89	53.77	2 11 53.7 +456.9	3 20.3	6.74	.304 821	0 36 10
20	8 25 18.83 - 53.11	+0 53.82	+ 2 19 30.6 +470.1	-3 19.4	6.74	1.305 059	0 31 22
21	8 24 25.72 - 53.25	53.88	2 27 20.7 +483.0	3 18.5	6.74	.305 555	0 26 33
22	8 23 32.47 - 53.29	53.94	2 35 23.7 +495.2	3 17.6	6.74	.306 310	0 21 45
23	8 22 39.18 - 53.27	54.00	2 43 38.9 +507.0	3 16.7	6.73	.307 325	0 16 56
24	8 21 45.91 - 53.16	54.07	2 52 05.9 +518.3	3 15.7	6.72	.308 601	0 12 07
25	8 20 52.75 - 52.98	+0 54.14	+ 3 00 44.2 +529.0	-3 14.8	6.72	1.310 140	0 07 18
26	8 19 59.77 - 52.72	54.20	3 09 33.2 +539.2	3 13.8	6.71	.311 941	{ 0 02 30 } { 23 57 42 }
27	8 19 07.05 - 52.39	54.27	3 18 32.4 +548.9	3 12.8	6.70	.314 005	23 52 54
28	8 18 14.66 - 51.97	54.33	3 27 41.3 +558.0	3 11.8	6.69	.316 333	23 48 06
29	8 17 22.69 - 51.49	54.39	3 36 59.3 +566.5	3 10.8	6.67	.318 924	23 43 19
30	8 16 31.20 - 50.93	+0 54.44	+ 3 46 25.8 +574.5	-3 09.8	6.66	1.321 780	23 38 33
31	8 15 40.27 - 50.30	54.50	3 56 00.3 +581.9	3 08.8	6.64	.324 900	23 33 47
Feb. 1*	8 14 49.97 - 49.59	54.56	4 05 42.2 +588.7	3 07.9	6.63	.328 284	23 29 02
2	8 14 00.38 - 48.82	54.62	4 15 30.9 +595.0	3 07.0	6.61	.331 933	23 24 17
3	8 13 11.56 - 47.96	54.68	4 25 25.9 +600.7	3 06.1	6.59	.335 845	23 19 34
4	8 12 23.60 - 47.04	+0 54.75	+ 4 35 26.6 +605.7	-3 05.2	6.57	1.340 021	23 14 51
5	8 11 36.56 - 46.06	54.82	4 45 32.3 +610.2	3 04.4	6.55	.344 459	23 10 09
6	8 10 50.50 - 44.99	54.89	4 55 42.5 +614.1	3 03.5	6.52	.349 159	23 05 29
7	8 10 05.51 - 43.88	54.96	5 05 56.6 +617.3	3 02.6	6.50	.354 118	23 00 49
8	8 09 21.63 - 42.69	55.03	5 16 13.9 +620.0	3 01.7	6.47	.359 336	22 56 11
9	8 08 38.94 - 41.45	+0 55.09	+ 5 26 33.9 +622.1	-3 00.8	6.45	1.364 811	22 51 34
10	8 07 57.49 - 40.14	55.15	5 36 56.0 +623.6	3 00.0	6.42	.370 541	22 46 58
11	8 07 17.35 - 38.80	55.21	5 47 19.6 +624.4	2 59.1	6.39	.376 523	22 42 23
12	8 06 38.55 - 37.40	55.27	5 57 44.0 +624.8	2 58.3	6.36	.382 754	22 37 50
13	8 06 01.15 - 35.94	55.32	6 08 08.8 +624.6	2 57.5	6.33	.389 233	22 33 19
14	8 05 25.21 - 34.46	+0 55.38	+ 6 18 33.4 +623.8	-2 56.8	6.30	1.395 956	22 28 49
15*	8 04 50.75 - 34.46	+0 55.43	+ 6 28 57.2 +623.8	-2 56.1	6.27	1.402 921	22 24 20

Photographic Magnitude : Jan. 10, 8.7 ; Jan. 30, 8.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Feb. 15*	8 04 50.75 - 32.93	+0 55.43	+ 6 28 57.2 +622.5	-2 56.1	6.27	1.402 921	22 24 20
16	8 04 17.82 - 31.36	55.49	6 39 19.7 +626.8	2 55.4	6.24	.410 124	22 19 53
17	8 03 46.46 - 29.77	55.55	6 49 40.5 +618.5	2 54.8	6.21	.417 562	22 15 27
18	8 03 16.69 - 28.13	55.61	6 59 59.0 +615.8	2 54.2	6.17	.425 232	22 11 03
19	8 02 48.56 - 26.49	55.67	7 10 14.8 +612.5	2 53.6	6.14	.433 130	22 06 41
20	8 02 22.07 - 24.80	+0 55.73	+ 7 20 27.3 +609.0	-2 53.1	6.11	1.441 252	22 02 20
21	8 01 57.27 - 23.11	55.79	7 30 36.3 +605.0	2 52.6	6.07	.449 596	21 58 01
22	8 01 34.16 - 21.40	55.86	7 40 41.3 +600.5	2 52.1	6.04	.458 157	21 53 44
23	8 01 12.76 - 19.68	55.92	7 50 41.8 +595.8	2 51.6	6.00	.466 933	21 49 28
24	8 00 53.08 - 17.94	55.97	8 00 37.6 +590.7	2 51.2	5.96	.475 918	21 45 15
25	8 00 35.14 - 16.19	+0 56.02	+ 8 10 28.3 +585.2	-2 50.7	5.93	1.485 110	21 41 02
26	8 00 18.95 - 14.45	56.07	8 20 13.5 +579.6	2 50.3	5.89	.494 506	21 36 52
27	8 00 04.50 - 12.68	56.12	8 29 53.1 +573.5	2 49.9	5.85	.504 102	21 32 43
28*	7 59 51.82 - 10.92	56.16	8 39 26.6 +567.3	2 49.7	5.81	.513 895	21 28 37
Mar. 1	7 59 40.90 - 9.15	56.21	8 48 53.9 +560.7	2 49.4	5.77	.523 882	21 24 31
2	7 59 31.75 - 7.38	+0 56.25	+ 8 58 14.6 +554.0	-2 49.3	5.74	1.534 058	21 20 28
3	7 59 24.37 - 5.60	56.30	9 07 28.6 +546.9	2 49.1	5.70	.544 422	21 16 26
4	7 59 18.77 - 3.82	56.36	9 16 35.5 +539.7	2 49.0	5.66	.554 969	21 12 27
5	7 59 14.95 - 2.05	56.41	9 25 35.2 +532.2	2 49.0	5.62	.565 695	21 08 28
6	7 59 12.90 - 0.28	56.46	9 34 27.4 +524.5	2 48.9	5.58	.576 598	21 04 32
7	7 59 12.62 + 1.50	+0 56.50	+ 9 43 11.9 +516.7	-2 48.8	5.54	1.587 673	21 00 37
8	7 59 14.12 + 3.26	56.55	9 51 48.6 +508.7	2 48.8	5.50	.598 917	20 56 45
9	7 59 17.38 + 5.01	56.59	10 00 17.3 +500.4	2 48.8	5.46	.610 326	20 52 54
10	7 59 22.39 + 6.77	56.62	10 08 37.7 +492.0	2 48.8	5.43	.621 895	20 49 04
11	7 59 29.16 + 8.50	56.66	10 16 49.7 +483.5	2 48.9	5.39	.633 621	20 45 17
12	7 59 37.66 + 10.23	+0 56.69	+ 10 24 53.2 +474.8	-2 49.0	5.35	1.645 500	20 41 31
13	7 59 47.89 + 11.95	56.71	10 32 48.0 +466.1	2 49.2	5.31	.657 528	20 37 46
14*	7 59 59.84 + 13.63	56.74	10 40 34.1 +457.2	2 49.4	5.27	.669 701	20 34 04
15	8 00 13.47 + 15.32	56.77	10 48 11.3 +448.2	2 49.7	5.23	.682 014	20 30 23
16	8 00 28.79 + 16.98	56.80	10 55 39.5 +439.1	2 50.0	5.19	.694 465	20 26 44
17	8 00 45.77 + 18.62	+0 56.83	+ 11 02 58.6 +430.0	-2 50.3	5.16	1.707 048	20 23 06
18	8 01 04.39 + 20.25	56.86	11 10 08.6 +422.7	2 50.7	5.12	.719 760	20 19 30
19	8 01 24.64 + 21.85	56.89	11 17 09.3 +411.5	2 51.2	5.08	.732 598	20 15 56
20	8 01 46.49 + 23.43	56.92	11 24 00.8 +402.2	2 51.6	5.04	.745 556	20 12 23
21	8 02 09.92 + 24.98	56.96	11 30 43.0 +392.8	2 52.1	5.00	.758 632	20 08 52
22	8 02 34.90 + 26.52	+0 56.98	+ 11 37 15.8 +383.5	-2 52.6	4.97	1.771 822	20 05 22
23	8 03 01.42 + 28.02	57.01	11 43 39.3 +374.1	2 53.0	4.93	.785 123	20 01 54
24	8 03 29.44 + 29.50	57.03	11 49 53.4 +364.7	2 53.6	4.89	.798 530	19 58 27
25	8 03 58.94 + 30.97	57.05	11 55 58.1 +355.3	2 54.1	4.86	.812 041	19 55 02
26	8 04 29.91 + 32.40	57.06	12 01 53.4 +346.0	2 54.7	4.82	.825 653	19 51 38
27	8 05 02.31 + 33.81	+0 57.07	+ 12 07 39.4 +336.7	-2 55.3	4.78	1.839 363	19 48 15
28*	8 05 36.12 + 35.19	57.08	12 13 16.1 +327.3	2 56.0	4.75	.853 167	19 44 54
29	8 06 11.31 + 36.57	57.09	12 18 43.4 +318.0	2 56.7	4.71	.867 064	19 41 34
30	8 06 47.88 + 37.91	57.11	12 24 01.4 +308.7	2 57.5	4.68	.881 050	19 38 16
31	8 07 25.79 + 39.23	57.13	12 29 10.1 +299.4	2 58.3	4.64	.895 123	19 34 59
Apr. 1	8 08 05.02 + 40.54	+0 57.15	+ 12 34 09.5 +290.2	-2 59.2	4.61	1.909 279	19 31 43
2	8 08 45.56 + 42.00	+0 57.16	+ 12 38 59.7 +280.0	-3 00.0	4.57	1.923 517	19 28 28

Photographic Magnitude : Feb. 19, 9.0 ; Mar. 11, 9.3 ; Mar. 31, 9.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephe- meris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	["]	["]		^h ^m ^s
Apr. 1	8 08 05.02 ⁺	+0 57.15	+12 34 09.5 ⁺	-2 59.2	4.61	1.909 279	19 31 43
2	8 08 45.56 ⁺	57.16	12 38 59.7 ⁺	3 00.0	4.57	.923 517	19 28 28
3	8 09 27.39	57.18	12 43 40.6	3 00.8	4.54	.937 832	19 25 15
4	8 10 10.48	57.19	12 48 12.3	3 01.7	4.51	.952 223	19 22 03
5	8 10 54.81	57.20	12 52 34.8	3 02.5	4.47	.966 686	19 18 52
6	8 11 40.36	+0 57.20	+12 56 48.1	-3 03.4	4.44	1.981 218	19 15 43
7	8 12 27.12 ⁺	57.20	13 00 52.3 ⁺	3 04.3	4.41	1.995 816	19 12 34
8	8 13 15.05	57.19	13 04 47.3	3 05.2	4.38	2.010 478	19 09 27
9	8 14 04.14	57.19	13 08 33.3	3 06.2	4.35	.025 199	19 06 21
10	8 14 54.37	57.18	13 12 10.1	3 07.2	4.31	.039 978	19 03 16
11*	8 15 45.71 ⁺	+0 57.17	+13 15 38.0 ⁺	-3 08.2	4.28	2.054 811	19 00 12
12	8 16 38.14 ⁺	57.17	13 18 56.9 ⁺	3 09.2	4.25	.069 695	18 57 09
13	8 17 31.64	57.16	13 22 06.9	3 10.3	4.22	.084 627	18 54 07
14	8 18 26.18	57.16	13 25 08.0	3 11.5	4.19	.099 605	18 51 06
15	8 19 21.75	57.16	13 28 00.3	3 12.6	4.16	.114 625	18 48 06
16	8 20 18.33 ⁺	+0 57.16	+13 30 43.7 ⁺	-3 13.7	4.13	2.129 685	18 45 08
17	8 21 15.88 ⁺	57.16	13 33 18.5 ⁺	3 14.9	4.10	.144 783	18 42 10
18	8 22 14.38	57.16	13 35 44.6	3 16.0	4.07	.159 914	18 39 13
19	8 23 13.82	57.15	13 38 02.1	3 17.2	4.05	.175 078	18 36 17
20	8 24 14.16	57.14	13 40 11.0	3 18.3	4.02	.190 271	18 33 22
21	8 25 15.39 ⁺	+0 57.13	+13 42 11.6 ⁺	-3 19.5	3.99	2.205 492	18 30 27
22	8 26 17.49 ⁺	57.11	13 44 03.7 ⁺	3 20.6	3.96	.220 737	18 27 34
23	8 27 20.42	57.09	13 45 47.5	3 21.8	3.94	.236 006	18 24 41
24*	8 28 24.18	57.07	13 47 23.0	3 23.1	3.91	.251 295	18 21 49
25	8 29 28.74	57.05	13 48 50.4	3 24.4	3.88	.266 605	18 18 58
26	8 30 34.09 ⁺	+0 57.03	+13 50 09.8 ⁺	-3 25.7	3.86	2.281 931	18 16 08
27	8 31 40.20 ⁺	57.02	13 51 21.0 ⁺	3 27.0	3.83	.297 274	18 13 18
28	8 32 47.05	57.01	13 52 24.3	3 28.3	3.81	.312 631	18 10 29
29	8 33 54.65	57.00	13 53 19.8	3 29.7	3.78	.328 001	18 07 41
30	8 35 02.95	56.99	13 54 07.3	3 31.0	3.76	.343 381	18 04 54
May 1	8 36 11.97 ⁺	+0 56.97	+13 54 47.1 ⁺	-3 32.3	3.73	2.358 769	18 02 07
2	8 37 21.66 ⁺	56.95	13 55 19.1 ⁺	3 33.6	3.71	.374 164	17 59 21
3	8 38 32.04	56.93	13 55 43.5	3 34.9	3.68	.389 563	17 56 36
4	8 39 43.06	56.90	13 56 00.3	3 36.2	3.66	.404 965	17 53 51
5	8 40 54.73	56.87	13 56 09.5 ⁺	3 37.5	3.64	.420 367	17 51 07
6	8 42 07.03 ⁺	+0 56.84	+13 56 11.1 ⁺	-3 38.8	3.61	2.435 767	17 48 23
7	8 43 19.93 ⁺	56.80	13 56 05.4	3 40.1	3.59	.451 163	17 45 40
8	8 44 33.44	56.77	13 55 52.3	3 41.5	3.57	.466 553	17 42 58
9*	8 45 47.52	56.74	13 55 31.8	3 42.9	3.55	.481 934	17 40 16
10	8 47 02.17	56.71	13 55 04.0	3 44.3	3.52	.497 306	17 37 35
11	8 48 17.37 ⁺	+0 56.68	+13 54 29.1 ⁺	-3 45.7	3.50	2.512 665	17 34 54
12	8 49 33.11 ⁺	56.66	13 53 47.0	3 47.1	3.48	.528 009	17 32 14
13	8 50 49.38	56.63	13 52 57.9	3 48.5	3.46	.543 337	17 29 35
14	8 52 06.14	56.61	13 52 01.7	3 49.9	3.44	.558 647	17 26 55
15	8 53 23.40	56.58	13 50 58.7	3 51.3	3.42	.573 935	17 24 17
16	8 54 41.14 ⁺	+0 56.56	+13 49 48.7 ⁺	-3 52.7	3.40	2.589 202	17 21 38
17	8 55 59.34 ⁺	+0 56.53	+13 48 32.0 ⁺	-3 54.0	3.38	2.604 444	17 19 01

Photographic Magnitude : Apr. 20, 10.0 ; May 10, 10.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950-0	App. -Astr.	Astrometric 1950-0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]			^h ^m ^s
May 17	8 55 59.34	+0 56.53	+13 48 32.0	-83.5	3 38	2.604 444	17 19 01
18	8 57 17.98 ⁺	56.49	13 47 08.5	90.1	3 36	619 661	17 16 23
19	8 58 37.06	56.45	13 45 38.4	96.6	3 34	634 850	17 13 46
20	8 59 56.55	56.41	13 44 01.8	103.2	3 32	650 010	17 11 10
21	9 01 16.45	56.37	13 42 18.6	109.5	3 30	665 140	17 08 34
22*	9 02 36.74 ⁺	+0 56.33	+13 40 29.1	-115.9	3 28	2.680 239	17 05 58
23	9 03 57.41	56.30	13 38 33.2	122.1	3 26	695 305	17 03 23
24	9 05 18.45	56.26	13 36 31.1	128.4	3 25	710 337	17 00 48
25	9 06 39.85	56.23	13 34 22.7	134.5	3 23	725 334	16 58 13
26	9 08 01.59	56.20	13 32 08.2	140.5	3 21	740 296	16 55 39
27	9 09 23.68	+0 56.18	+13 29 47.7	-146.6	3 19	2.755 220	16 53 05
28	9 10 46.10	56.14	13 27 21.1	152.5	3 18	770 106	16 50 31
29	9 12 08.84	56.11	13 24 48.6	158.4	3 16	784 952	16 47 58
30	9 13 31.89	56.07	13 22 10.2	164.3	3 14	799 756	16 45 24
31	9 14 55.25	56.03	13 19 25.9	170.1	3 13	814 518	16 42 52
June 1	9 16 18.91	+0 55.98	+13 16 35.8	-175.8	3 11	2.829 235	16 40 19
2	9 17 42.85	55.94	13 13 40.0	181.5	3 09	843 906	16 37 47
3	9 19 07.08	55.89	13 10 38.5	187.1	3 08	858 530	16 35 15
4	9 20 31.58	55.84	13 07 31.4	192.7	3 06	873 104	16 32 44
5	9 21 56.35	55.80	13 04 18.7	198.2	3 05	887 627	16 30 12
6*	9 23 21.37	+0 55.76	+13 01 00.5	-203.6	3 03	2.902 098	16 27 41
7	9 24 46.63	55.72	12 57 36.9	209.0	3 02	916 515	16 25 10
8	9 26 12.14	55.68	12 54 07.9	214.3	3 00	930 876	16 22 39
9	9 27 37.88	55.64	12 50 33.6	219.6	2 99	945 179	16 20 09
10	9 29 03.84	55.61	12 46 54.0	224.8	2 97	959 424	16 17 39
11	9 30 30.02	+0 55.57	+12 43 09.2	-229.9	2 96	2.973 608	16 15 09
12	9 31 56.40	55.54	12 39 19.3	234.9	2 95	2.987 729	16 12 39
13	9 33 22.97	55.50	12 35 24.4	240.0	2 93	3.001 787	16 10 09
14	9 34 49.74	55.45	12 31 24.4	244.8	2 92	015 781	16 07 40
15	9 36 16.68	55.41	12 27 19.6	249.8	2 90	029 707	16 05 11
16	9 37 43.79	+0 55.36	+12 23 09.8	-254.4	2 89	3.043 567	16 02 41
17	9 39 11.07	55.31	12 18 55.4	259.2	2 88	057 358	16 00 12
18	9 40 38.50	55.26	12 14 36.2	263.8	2 87	071 080	15 57 44
19	9 42 06.08	55.22	12 10 12.4	268.4	2 85	084 731	15 55 15
20*	9 43 33.80	55.18	12 05 44.0	272.9	2 84	098 311	15 52 46
21	9 45 01.65	+0 55.14	+12 01 11.1	-277.3	2 83	3.111 819	15 50 18
22	9 46 29.64	55.11	11 56 33.8	281.7	2 82	125 254	15 47 50
23	9 47 57.75	55.07	11 51 52.1	286.0	2 80	138 616	15 45 22
24	9 49 25.98	55.04	11 47 06.1	290.3	2 79	151 903	15 42 54
25	9 50 54.33	55.00	11 42 15.8	294.5	2 78	165 115	15 40 26
26	9 52 22.80	+0 54.96	+11 37 21.3	-298.7	2 77	3.178 250	15 37 58
27	9 53 51.37	54.91	11 32 22.6	302.8	2 76	191 308	15 35 30
28	9 55 20.05	54.87	11 27 19.8	306.9	2 75	204 287	15 33 02
29	9 56 48.83	54.82	11 22 12.9	310.9	2 74	217 186	15 30 35
30	9 58 17.71	54.77	11 17 02.0	314.9	2 72	230 003	15 28 08
July 1	9 59 46.68	+0 54.72	+11 11 47.1	-318.7	2 71	3.242 738	15 25 40
2	10 01 15.75	+0 54.68	+11 06 28.4	318.7	2 70	3.255 388	15 23 13

Photographic Magnitude : May 30, 10.7 ; June 19, 10.9

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
July 1	^{h m s} 9 59 46.68 + ^s 89.07	^{m s} +0 54.72	^{° ' "} +11 11 47.1 - ["] 318.7	^{' "} -4 52.8	["] 2.71	3.242 738	^{h m s} 15 25 40
2	10 01 15.75 + 89.15	54.68	11 06 28.4 - 322.7	4 53.9	2.70	.255 388	15 23 13
3	10 02 44.90 + 89.23	54.63	11 01 05.7 - 326.4	4 55.1	2.69	.267 954	15 20 46
4*	10 04 14.13 + 89.31	54.59	10 55 39.3 - 330.2	4 56.2	2.68	.280 433	15 18 19
5	10 05 43.44 + 89.39	54.55	10 50 09.1 - 333.8	4 57.3	2.67	.292 823	15 15 52
6	10 07 12.83 + 89.45	+0 54.52	+10 44 35.3 - 337.5	-4 58.5	2.66	3.305 125	15 13 25
7	10 08 42.28 + 89.52	54.48	10 38 57.8 - 341.1	4 59.6	2.65	.317 335	15 10 58
8	10 10 11.80 + 89.58	54.45	10 33 16.7 - 344.6	5 00.7	2.64	.329 453	15 08 31
9	10 11 41.38 + 89.64	54.41	10 27 32.1 - 348.0	5 01.7	2.63	.341 478	15 06 05
10	10 13 11.02 + 89.69	54.38	10 21 44.1 - 351.4	5 02.8	2.62	.353 408	15 03 38
11	10 14 40.71 + 89.73	+0 54.34	+10 15 52.7 - 354.8	-5 03.8	2.61	3.365 242	15 01 11
12	10 16 10.44 + 89.78	54.29	10 09 57.9 - 358.0	5 04.7	2.61	.376 978	14 58 45
13	10 17 40.22 + 89.81	54.25	10 03 59.9 - 361.1	5 05.7	2.60	.388 617	14 56 18
14	10 19 10.03 + 89.84	54.20	9 57 58.8 - 364.3	5 06.7	2.59	.400 156	14 53 52
15	10 20 39.87 + 89.87	54.16	9 51 54.5 - 367.4	5 07.6	2.58	.411 595	14 51 25
16	10 22 09.74 + 89.90	+0 54.12	+ 9 45 47.1 - 370.3	-5 08.6	2.57	3.422 934	14 48 59
17	10 23 39.64 + 89.92	54.08	9 39 36.8 - 373.3	5 09.6	2.56	.434 172	14 46 32
18*	10 25 09.56 + 89.93	54.05	9 33 23.5 - 376.1	5 10.6	2.55	.445 307	14 44 06
19	10 26 39.49 + 89.95	54.01	9 27 07.4 - 379.0	5 11.6	2.55	.456 340	14 41 39
20	10 28 09.44 +	+0 53.99	+ 9 20 48.4	-5 12.5	2.54	3.467 270	14 39 13

Photographic Magnitude : July 9, 11.1 ; July 29, 11.3

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

JUNO, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	<small>h m s</small>	<small>m s</small>	<small>° ' "</small>	<small>' "</small>			<small>h m s</small>
Nov. 26	13 33 58.09 ^s	+0 54.36	- 5 30 00.8	-5 23.9	2.35	3.750 277	9 16 54
27	13 35 15.39 ⁺ 77.30	54.40	5 35 03.0 ^{-302.2}	5 23.3	2.35	.742 802	9 14 15
28	13 36 32.41 ^{77.02}	54.44	5 40 01.1 ^{298.1}	5 22.6	2.36	.735 184	9 11 36
29	13 37 49.13 ^{76.72}	54.48	5 44 55.2 ^{294.1}	5 21.9	2.36	.727 427	9 08 56
30	13 39 05.55 ^{76.42}	54.52	5 49 45.2 ^{290.0}	5 21.3	2.37	.719 529	9 06 16
		^{76.11}	^{285.8}				
Dec. 1	13 40 21.66 ⁺	+0 54.57	- 5 54 31.0	-5 20.6	2.37	3.711 494	9 03 36
2	13 41 37.45 ^{75.79}	54.63	5 59 12.6 ^{-281.6}	5 20.0	2.38	.703 320	9 00 56
3	13 42 52.91 ^{75.46}	54.69	6 03 49.8 ^{277.2}	5 19.4	2.38	.695 011	8 58 15
4*	13 44 08.05 ^{75.14}	54.74	6 08 22.7 ^{272.9}	5 18.8	2.39	.686 568	8 55 34
5	13 45 22.84 ^{74.79}	54.80	6 12 51.2 ^{268.5}	5 18.2	2.39	.677 991	8 52 52
		^{74.44}	^{264.0}				
6	13 46 37.28 ⁺	+0 54.85	- 6 17 15.2	-5 17.6	2.40	3.669 283	8 50 10
7	13 47 51.37 ^{74.09}	54.90	6 21 34.6 ^{-259.4}	5 16.9	2.40	.660 445	8 47 28
8	13 49 05.10 ^{73.73}	54.94	6 25 49.6 ^{255.0}	5 16.3	2.41	.651 478	8 44 45
9	13 50 18.47 ^{73.37}	54.98	6 29 59.9 ^{250.3}	5 15.6	2.42	.642 385	8 42 02
10	13 51 31.45 ^{72.98}	55.03	6 34 05.6 ^{245.7}	5 14.9	2.42	.633 166	8 39 19
		^{72.61}	^{240.9}				
11	13 52 44.06 ⁺	+0 55.07	- 6 38 06.5	-5 14.1	2.43	3.623 823	8 36 35
12	13 53 56.28 ^{72.22}	55.11	6 42 02.8 ^{-236.3}	5 13.4	2.43	.614 358	8 33 51
13	13 55 08.11 ^{71.83}	55.16	6 45 54.2 ^{231.4}	5 12.7	2.44	.604 771	8 31 07
14	13 56 19.53 ^{71.42}	55.21	6 49 40.8 ^{226.6}	5 12.0	2.45	.595 065	8 28 22
15	13 57 30.54 ^{71.01}	55.26	6 53 22.6 ^{221.8}	5 11.3	2.45	.585 240	8 25 36
		^{70.60}	^{216.9}				
16	13 58 41.14 ⁺	+0 55.31	- 6 56 59.5	-5 10.6	2.46	3.575 298	8 22 51
17	13 59 51.32 ^{70.18}	55.36	7 00 31.3 ^{-211.8}	5 09.9	2.47	.565 240	8 20 04
18	14 01 01.07 ^{69.75}	55.42	7 03 58.2 ^{206.9}	5 09.2	2.48	.555 067	8 17 18
19*	14 02 10.37 ^{69.30}	55.47	7 07 20.0 ^{201.8}	5 08.5	2.48	.544 782	8 14 31
20	14 03 19.23 ^{68.86}	55.53	7 10 36.8 ^{196.8}	5 07.9	2.49	.534 384	8 11 43
		^{68.41}	^{191.5}				
21	14 04 27.64 ⁺	+0 55.58	- 7 13 48.3	-5 07.2	2.50	3.523 876	8 08 55
22	14 05 35.57 ^{67.93}	55.62	7 16 54.7 ^{-186.4}	5 06.5	2.50	.513 258	8 06 07
23	14 06 43.04 ^{67.47}	55.67	7 19 55.8 ^{181.1}	5 05.8	2.51	.502 533	8 03 18
24	14 07 50.02 ^{66.98}	55.71	7 22 51.6 ^{175.8}	5 05.1	2.52	.491 701	8 00 29
25	14 08 56.51 ^{66.49}	55.76	7 25 42.0 ^{170.4}	5 04.3	2.53	.480 764	7 57 39
		^{65.98}	^{165.0}				
26	14 10 02.49 ⁺	+0 55.80	- 7 28 27.0	-5 03.6	2.54	3.469 724	7 54 49
27	14 11 07.96 ^{65.47}	55.85	7 31 06.5 ^{-159.5}	5 02.8	2.54	.458 582	7 51 58
28	14 12 12.90 ^{64.94}	55.90	7 33 40.4 ^{153.9}	5 02.1	2.55	.447 340	7 49 06
29	14 13 17.30 ^{64.40}	55.95	7 36 08.8 ^{148.4}	5 01.4	2.56	.436 000	7 46 14
30	14 14 21.15 ^{63.85}	56.01	7 38 31.4 ^{142.6}	5 00.7	2.57	.424 564	7 43 22
		^{63.29}	^{137.0}				
31	14 15 24.44 ⁺	+0 56.06	- 7 40 48.4	-5 00.1	2.58	3.413 035	7 40 29
32*	14 16 27.15 ^{62.71}	+0 56.12	- 7 42 59.5 ^{-131.1}	-4 59.4	2.59	3.401 415	7 37 35

Photographic Magnitude : Nov. 26, 11.6 ; Dec. 16, 11.5 ; Dec. 36, 11.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967
FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Jan. 0	^h 14 ^m 18 ^s 40.61 ^s	+0 52.50	— 7 03 53.5	— 4 38.7	3.52	2.499 824	^h 7 ^m 42 ^s 56
1	14 20 21.16 ^{+100.55}	52.56	7 10 42.3 ^{-408.8}	4 37.5	3.54	.487 991	7 40 40
2	14 22 01.40 ^{100.24}	52.62	7 17 25.7 ^{403.4}	4 36.3	3.55	.476 112	7 38 24
3	14 23 41.35 ^{99.95}	52.68	7 24 03.6 ^{397.9}	4 35.0	3.57	.464 188	7 36 08
4	14 25 20.99 ^{99.64}	52.74	7 30 36.1 ^{392.5}	4 33.8	3.59	.452 220	7 33 51
			386.9				
5	14 27 00.30 ^{+98.97}	+0 52.80	— 7 37 03.0	— 4 32.5	3.61	2.440 209	7 31 34
6	14 28 39.27 ^{98.63}	52.87	7 43 24.3 ^{-381.3}	4 31.2	3.62	.428 155	7 29 17
7	14 30 17.90 ^{98.26}	52.94	7 49 39.9 ^{375.6}	4 29.9	3.64	.416 061	7 26 59
8	14 31 56.16 ^{97.90}	53.01	7 55 49.7 ^{369.8}	4 28.6	3.66	.403 927	7 24 41
9	14 33 34.06 ^{97.50}	53.08	8 01 53.7 ^{364.0}	4 27.3	3.68	.391 754	7 22 22
			358.2				
10	14 35 11.56 ^{+97.12}	+0 53.15	— 8 07 51.9	— 4 26.1	3.70	2.379 544	7 20 03
11	14 36 48.68 ^{96.70}	53.23	8 13 44.2 ^{-352.3}	4 24.8	3.72	.367 299	7 17 44
12*	14 38 25.38 ^{96.28}	53.30	8 19 30.5 ^{346.3}	4 23.5	3.74	.355 019	7 15 24
13	14 40 01.66 ^{95.86}	53.36	8 25 10.9 ^{340.4}	4 22.2	3.76	.342 707	7 13 04
14	14 41 37.52 ^{95.40}	53.43	8 30 45.3 ^{334.4}	4 20.9	3.78	.330 364	7 10 44
			328.3				
15	14 43 12.92 ^{+94.96}	+0 53.49	— 8 36 13.6	— 4 19.6	3.80	2.317 991	7 08 23
16	14 44 47.88 ^{94.48}	53.55	8 41 35.8 ^{-322.2}	4 18.3	3.82	.305 590	7 06 01
17	14 46 22.36 ^{94.01}	53.61	8 46 51.9 ^{316.1}	4 16.9	3.84	.293 163	7 03 39
18	14 47 56.37 ^{93.52}	53.66	8 52 01.9 ^{310.0}	4 15.5	3.86	.280 710	7 01 17
19	14 49 29.89 ^{93.01}	53.73	8 57 05.8 ^{303.9}	4 14.1	3.88	.268 233	6 58 54
			297.6				
20	14 51 02.90 ^{+92.51}	+0 53.79	— 9 02 03.4	— 4 12.7	3.90	2.255 733	6 56 31
21	14 52 35.41 ^{91.97}	53.85	9 06 54.9 ^{-291.5}	4 11.3	3.92	.243 213	6 54 07
22	14 54 07.38 ^{91.44}	53.92	9 11 40.1 ^{285.2}	4 09.9	3.94	.230 673	6 51 42
23	14 55 38.82 ^{90.89}	53.99	9 16 19.2 ^{279.1}	4 08.6	3.97	.218 114	6 49 17
24	14 57 09.71 ^{90.33}	54.06	9 20 51.9 ^{272.7}	4 07.2	3.99	.205 538	6 46 52
			266.5				
25	14 58 40.04 ^{+89.75}	+0 54.13	— 9 25 18.4	— 4 05.9	4.01	2.192 945	6 44 26
26*	15 00 09.79 ^{89.16}	54.20	9 29 38.6 ^{-260.2}	4 04.5	4.04	.180 338	6 41 59
27	15 01 38.95 ^{88.56}	54.26	9 33 52.5 ^{253.9}	4 03.2	4.06	.167 716	6 39 32
28	15 03 07.51 ^{87.94}	54.32	9 38 00.1 ^{247.6}	4 01.9	4.08	.155 081	6 37 04
29	15 04 35.45 ^{87.31}	54.38	9 42 01.3 ^{241.2}	4 00.5	4.11	.142 434	6 34 36
			234.8				
30	15 06 02.76 ^{+86.65}	+0 54.44	— 9 45 56.1	— 3 59.1	4.13	2.129 777	6 32 07
31	15 07 29.41 ^{85.98}	54.49	9 49 44.5 ^{-228.4}	3 57.7	4.16	.117 109	6 29 37
Feb. 1	15 08 55.39 ^{85.29}	54.54	9 53 26.5 ^{222.0}	3 56.3	4.18	.104 432	6 27 06
2	15 10 20.68 ^{84.58}	54.60	9 57 01.9 ^{215.4}	3 54.9	4.21	.091 748	6 24 35
3	15 11 45.26 ^{83.86}	54.66	10 00 30.9 ^{209.0}	3 53.5	4.23	.079 058	6 22 03
			202.4				
4	15 13 09.12 ^{+83.10}	+0 54.72	— 10 03 53.3	— 3 52.1	4.26	2.066 364	6 19 31
5	15 14 32.22 ^{82.34}	54.79	10 07 09.2 ^{-195.9}	3 50.7	4.29	.053 667	6 16 57
6	15 15 54.56 ^{81.55}	54.85	10 10 18.4 ^{189.2}	3 49.4	4.31	.040 969	6 14 23
7	15 17 16.11 ^{80.74}	54.92	10 13 21.1 ^{182.7}	3 48.1	4.34	.028 272	6 11 48
8	15 18 36.85 ^{79.91}	54.98	10 16 17.2 ^{176.1}	3 46.7	4.37	.015 577	6 09 13
			169.5				
9*	15 19 56.76 ^{+79.07}	+0 55.03	— 10 19 06.7	— 3 45.4	4.39	2.002 888	6 06 36
10	15 21 15.83 ^{78.19}	55.08	10 21 49.6 ^{-162.9}	3 44.1	4.42	.1990 205	6 03 59
11	15 22 34.02 ^{77.32}	55.13	10 24 25.8 ^{156.2}	3 42.8	4.45	.977 531	6 01 21
12	15 23 51.34 ^{76.41}	55.18	10 26 55.5 ^{149.7}	3 41.5	4.48	.964 867	5 58 42
13	15 25 07.75 ^{75.48}	55.23	10 29 18.7 ^{143.2}	3 40.1	4.51	.952 216	5 56 01
			136.5				
14	15 26 23.23 ^{+74.54}	+0 55.27	— 10 31 35.2	— 3 38.8	4.54	1.939 580	5 53 21
15	15 27 37.77	+0 55.32	— 10 33 45.3 ^{-130.1}	— 3 37.5	4.57	1.926 960	5 50 39

Photographic Magnitude : Jan. 10, 7.9 ; Jan. 30, 7.6

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Feb. 15	15 27 37.77 + 73.58	+0 55:32	-10 33 45.3 - 123.4	-3 37.5	4.57	1.926 960	5 50 39
16	15 28 51.35 + 72.59	55:37	10 35 48.7 117.0	3 36.1	4.60	.914 358	5 47 56
17	15 30 03.94 + 71.60	55:41	10 37 45.7 110.6	3 34.8	4.63	.901 777	5 45 12
18	15 31 15.54 + 70.57	55:46	10 39 36.3 104.1	3 33.5	4.66	.889 218	5 42 27
19	15 32 26.11 + 69.53	55:52	10 41 20.4 97.6	3 32.3	4.69	.876 683	5 39 41
20	15 33 35.64 + 68.48	+0 55:57	-10 42 58.0 - 91.3	-3 31.0	4.72	1.864 175	5 36 54
21	15 34 44.12 + 67.39	55:62	10 44 29.3 84.9	3 29.8	4.75	.851 694	5 34 06
22	15 35 51.51 + 66.30	55:68	10 45 54.2 78.6	3 28.7	4.78	.839 242	5 31 17
23*	15 36 57.81 + 65.17	55:73	10 47 12.8 72.3	3 27.5	4.82	.826 822	5 28 27
24	15 38 02.98 + 64.03	55:77	10 48 25.1 66.0	3 26.4	4.85	.814 434	5 25 36
25	15 39 07.01 + 62.87	+0 55:81	-10 49 31.1 - 59.8	-3 25.3	4.88	1.802 081	5 22 44
26	15 40 09.88 + 61.67	55:85	10 50 30.9 53.5	3 24.1	4.92	.789 764	5 19 50
27	15 41 11.55 + 60.46	55:88	10 51 24.4 47.3	3 23.0	4.95	.777 485	5 16 55
28	15 42 12.01 + 59.22	55:92	10 52 11.7 41.1	3 21.8	4.99	.765 245	5 13 59
Mar. 1	15 43 11.23 + 57.95	55:95	10 52 52.8 34.9	3 20.7	5.02	.753 046	5 11 02
2	15 44 09.18 + 56.66	+0 55:99	-10 53 27.7 - 28.8	-3 19.6	5.05	1.740 891	5 08 04
3	15 45 05.84 + 55.33	56:04	10 53 56.5 22.6	3 18.5	5.09	.728 781	5 05 04
4	15 46 01.17 + 53.98	56:08	10 54 19.1 16.5	3 17.5	5.13	.716 719	5 02 03
5	15 46 55.15 + 52.61	56:12	10 54 35.6 10.5	3 16.5	5.16	.704 707	4 59 00
6	15 47 47.76 + 51.20	56:17	10 54 46.1 - 4.5	3 15.5	5.20	.692 748	4 55 57
7	15 48 38.96 + 49.77	+0 56:21	-10 54 50.6 + 1.4	-3 14.6	5.24	1.680 845	4 52 51
8	15 49 28.73 + 48.31	56:24	10 54 49.2 7.4	3 13.7	5.27	.668 999	4 49 45
9*	15 50 17.04 + 46.84	56:27	10 54 41.8 13.1	3 12.8	5.31	.657 215	4 46 37
10	15 51 03.88 + 45.33	56:30	10 54 28.7 18.9	3 12.0	5.35	.645 494	4 43 27
11	15 51 49.21 + 43.80	56:33	10 54 09.8 24.6	3 11.1	5.39	.633 839	4 40 16
12	15 52 33.01 + 42.24	+0 56:35	-10 53 45.2 + 30.1	-3 10.3	5.42	1.622 254	4 37 03
13	15 53 15.25 + 40.66	56:38	10 53 15.1 35.7	3 09.4	5.46	.610 740	4 33 49
14	15 53 55.91 + 39.07	56:40	10 52 39.4 41.1	3 08.6	5.50	.599 301	4 30 33
15	15 54 34.98 + 37.44	56:42	10 51 58.3 46.3	3 07.9	5.54	.587 940	4 27 16
16	15 55 12.42 + 35.80	56:45	10 51 12.0 51.6	3 07.1	5.58	.576 660	4 23 57
17	15 55 48.22 + 34.13	+0 56:48	-10 50 20.4 + 56.8	-3 06.4	5.62	1.565 462	4 20 37
18	15 56 22.35 + 32.44	56:50	10 49 23.6 61.7	3 05.7	5.66	.554 351	4 17 14
19	15 56 54.79 + 30.74	56:53	10 48 21.9 66.6	3 05.1	5.70	.543 329	4 13 51
20	15 57 25.53 + 29.01	56:57	10 47 15.3 71.4	3 04.5	5.74	.532 398	4 10 25
21	15 57 54.54 + 27.27	56:60	10 46 03.9 76.2	3 04.0	5.78	.521 562	4 06 58
22	15 58 21.81 + 25.50	+0 56:62	-10 44 47.7 + 80.6	-3 03.6	5.82	1.510 823	4 03 29
23*	15 58 47.31 + 23.72	56:65	10 43 27.1 85.2	3 03.1	5.87	.500 184	3 59 58
24	15 59 11.03 + 21.91	56:67	10 42 01.9 89.5	3 02.7	5.91	.489 647	3 56 25
25	15 59 32.94 + 20.09	56:68	10 40 32.4 93.8	3 02.3	5.95	.479 215	3 52 51
26	15 59 53.03 + 18.25	56:69	10 38 58.6 97.9	3 02.0	5.99	.468 890	3 49 15
27	16 00 11.28 + 16.38	+0 56:71	-10 37 20.7 + 102.0	-3 01.6	6.03	1.458 676	3 45 37
28	16 00 27.66 + 14.50	56:72	10 35 38.7 105.9	3 01.3	6.07	.448 574	3 41 57
29	16 00 42.16 + 12.59	56:74	10 33 52.8 109.8	3 00.9	6.12	.438 589	3 38 15
30	16 00 54.75 + 10.67	56:76	10 32 03.0 113.5	3 00.7	6.16	.428 722	3 34 31
31	16 01 05.42 + 8.73	56:78	10 30 09.5 117.0	3 00.5	6.20	.418 977	3 30 46
Apr. 1	16 01 14.15 + 6.77	+0 56:80	-10 28 12.5 + 120.5	-3 00.4	6.24	1.409 358	3 26 58
2	16 01 20.92 + 6.77	+0 56:82	-10 26 12.0 + 120.5	-3 00.3	6.29	1.399 868	3 23 09

Photographic Magnitude : Feb. 19, 7.3 ; Mar. 11, 7.0 ; Mar. 31, 6.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
Apr. 1	^{h m s} 16 01 14.15	^{m s} +0 56.80	^{° ' "} -10 28 12.5	["] -3 00.4	6.24	1.409 358	^{h m s} 3 26 58
2	16 01 20.92 ⁺	56.82	10 26 12.0 ^{+120.5}	3 00.3	6.29	.399 868	3 23 09
3	16 01 25.71	56.84	10 24 08.3 ^{123.7}	3 00.3	6.33	.390 511	3 19 17
4	16 01 28.52	56.86	10 22 01.4 ^{126.9}	3 00.3	6.37	.381 289	3 15 24
5*	16 01 29.33 ⁺	56.87	10 19 51.5 ^{129.9}	3 00.3	6.41	.372 208	3 11 29
6	16 01 28.13 ⁻	+0 56.88	-10 17 38.9 ^{132.6}	-3 00.4	6.46	1.363 270	3 07 31
7	16 01 24.93 ⁻	56.88	10 15 23.6 ^{+135.3}	3 00.5	6.50	.354 479	3 03 32
8	16 01 19.71	56.89	10 13 06.0 ^{137.6}	3 00.7	6.54	.345 839	2 59 31
9	16 01 12.47	56.89	10 10 46.1 ^{139.9}	3 00.8	6.58	.337 354	2 55 27
10	16 01 03.22	56.89	10 08 24.3 ^{141.8}	3 01.0	6.62	.329 027	2 51 22
11	16 00 51.96 ⁻	+0 56.89	-10 06 00.6 ^{143.7}	-3 01.3	6.66	1.320 862	2 47 15
12	16 00 38.70 ⁻	56.90	10 03 35.4 ^{+145.2}	3 01.5	6.70	.312 862	2 43 05
13	16 00 23.44	56.91	10 01 08.8 ^{146.6}	3 01.8	6.74	.305 032	2 38 54
14	16 00 06.20	56.92	9 58 41.2 ^{147.6}	3 02.2	6.78	.297 374	2 34 41
15	15 59 47.00	56.93	9 56 12.6 ^{148.6}	3 02.6	6.82	.289 892	2 30 26
16	15 59 25.84 ⁻	+0 56.94	-9 53 43.4 ^{149.2}	-3 03.1	6.86	1.282 590	2 26 08
17	15 59 02.75 ⁻	56.95	9 51 13.9 ^{+149.5}	3 03.6	6.90	.275 470	2 21 49
18	15 58 37.76	56.96	9 48 44.1 ^{149.8}	3 04.2	6.94	.268 536	2 17 28
19*	15 58 10.88	56.96	9 46 14.5 ^{149.6}	3 04.8	6.97	.261 790	2 13 06
20	15 57 42.15	56.97	9 43 45.2 ^{149.3}	3 05.5	7.01	.255 236	2 08 41
21	15 57 11.59 ⁻	+0 56.97	-9 41 16.4 ^{148.8}	-3 06.2	7.05	1.248 877	2 04 15
22	15 56 39.23 ⁻	56.96	9 38 48.5 ^{+147.9}	3 06.9	7.08	.242 714	1 59 46
23	15 56 05.12	56.96	9 36 21.6 ^{146.9}	3 07.6	7.12	.236 752	1 55 16
24	15 55 29.27	56.95	9 33 56.0 ^{145.6}	3 08.3	7.15	.230 992	1 50 45
25	15 54 51.73	56.95	9 31 31.9 ^{144.1}	3 09.1	7.18	.225 437	1 46 11
26	15 54 12.54 ⁻	+0 56.96	-9 29 09.6 ^{142.3}	-3 09.9	7.21	1.220 090	1 41 36
27	15 53 31.73 ⁻	56.96	9 26 49.2 ^{+140.4}	3 10.7	7.24	.214 953	1 37 00
28	15 52 49.35	56.97	9 24 31.1 ^{138.1}	3 11.6	7.27	.210 030	1 32 22
29	15 52 05.44	56.98	9 22 15.5 ^{135.6}	3 12.5	7.30	.205 323	1 27 42
30	15 51 20.05	56.98	9 20 02.7 ^{132.8}	3 13.5	7.33	.200 836	1 23 01
May 1	15 50 33.25 ⁻	+0 56.99	-9 17 53.0 ^{129.7}	-3 14.5	7.35	1.196 570	1 18 18
2*	15 49 45.08 ⁻	56.99	9 15 46.6 ^{+126.4}	3 15.6	7.38	.192 529	1 13 35
3	15 48 55.61	56.98	9 13 43.8 ^{122.8}	3 16.6	7.40	.188 715	1 08 49
4	15 48 04.91	56.98	9 11 44.9 ^{118.9}	3 17.7	7.43	.185 130	1 04 03
5	15 47 13.03	56.97	9 09 50.2 ^{114.7}	3 18.7	7.45	.181 778	0 59 16
6	15 46 20.07 ⁻	+0 56.96	-9 08 00.0 ^{110.2}	-3 19.8	7.47	1.178 659	0 54 27
7	15 45 26.09 ⁻	56.95	9 06 14.6 ^{+105.4}	3 20.9	7.48	.175 776	0 49 37
8	15 44 31.16	56.94	9 04 34.2 ^{100.4}	3 21.9	7.50	.173 131	0 44 47
9	15 43 35.38	56.94	9 02 59.3 ^{94.9}	3 23.0	7.52	.170 725	0 39 55
10	15 42 38.81	56.93	9 01 30.0 ^{89.3}	3 24.1	7.53	.168 559	0 35 03
11	15 41 41.55 ⁻	+0 56.93	-9 00 06.6 ^{83.4}	-3 25.2	7.54	1.166 636	0 30 10
12	15 40 43.69 ⁻	56.93	8 58 49.5 ^{+77.1}	3 26.4	7.55	.164 955	0 25 17
13	15 39 45.31	56.94	8 57 38.8 ^{70.7}	3 27.6	7.56	.163 517	0 20 23
14	15 38 46.50	56.94	8 56 34.8 ^{64.0}	3 28.8	7.57	.162 322	0 15 29
15	15 37 47.35	56.94	8 55 37.9 ^{56.9}	3 30.0	7.58	.161 372	0 10 34
16*	15 36 47.95 ⁻	+0 56.94	-8 54 48.1 ^{49.8}	-3 31.2	7.58	1.160 666	0 05 39
17	15 35 48.39	+0 56.94	-8 54 05.8 ^{+42.3}	-3 32.4	7.58	1.160 203	{ 0 00 44 } { 23 55 49 }

Photographic Magnitude : Apr. 20, 6.4 ; May 10, 6.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
May 17	^h 15 ^m 35 ^s 48.39 ^s	^m +0 56.94	[°] - 8 54 05.8 ["]	["] -3 32.4	7.58	1.160 203	^h 00 ^m 00 ^s 44 ^s (23 55 49)
18	15 34 48.77 ^s 59.62	56.94	8 53 31.1 ["] + 34.7	3 33.6	7.59	1.159 983	23 50 54
19	15 33 49.16 ^s 59.61	56.93	8 53 04.2 ["] 26.9	3 34.8	7.59	1.160 006	23 45 59
20	15 32 49.66 ^s 59.50	56.92	8 52 45.3 ["] 18.9	3 35.9	7.58	1.160 270	23 41 04
21	15 31 50.35 ^s 59.31	56.91	8 52 34.6 ["] 10.7	3 37.0	7.58	1.160 774	23 36 09
22	15 30 51.31 ^s 59.04	+0 56.91	- 8 52 32.1 ["] + 2.5	-3 38.1	7.58	1.161 518	23 31 15
23	15 29 52.62 ^s 58.69	56.91	8 52 38.1 ["] - 6.0	3 39.2	7.57	1.162 500	23 26 21
24	15 28 54.37 ^s 58.25	56.91	8 52 52.6 ["] 14.5	3 40.3	7.56	1.163 719	23 21 28
25	15 27 56.63 ^s 57.74	56.92	8 53 15.8 ["] 23.2	3 41.4	7.55	1.165 174	23 16 35
26	15 26 59.47 ^s 57.16	56.93	8 53 47.7 ["] 31.9	3 42.5	7.54	1.166 863	23 11 43
27	15 26 02.99 ^s 56.48	+0 56.93	- 8 54 28.5 ["] 40.8	-3 43.6	7.53	1.168 785	23 06 52
28	15 25 07.24 ^s 55.75	56.94	8 55 18.2 ["] - 49.7	3 44.7	7.52	1.170 940	23 02 01
29*	15 24 12.31 ^s 54.93	56.94	8 56 17.0 ["] 58.8	3 45.8	7.50	1.173 324	22 57 11
30	15 23 18.27 ^s 54.04	56.94	8 57 25.0 ["] 68.0	3 46.8	7.48	1.175 938	22 52 23
31	15 22 25.19 ^s 53.08	56.94	8 58 42.2 ["] 77.2	3 47.8	7.47	1.178 778	22 47 35
June 1	15 21 33.14 ^s 52.05	+0 56.94	- 9 00 08.6 ["] 86.4	-3 48.8	7.45	1.181 844	22 42 48
2	15 20 42.21 ^s 50.93	56.93	9 01 44.4 ["] - 95.8	3 49.7	7.43	1.185 132	22 38 03
3	15 19 52.44 ^s 49.77	56.93	9 03 29.7 ["] 105.3	3 50.6	7.40	1.188 640	22 33 19
4	15 19 03.91 ^s 48.53	56.93	9 05 24.3 ["] 114.6	3 51.5	7.38	1.192 367	22 28 36
5	15 18 16.68 ^s 47.23	56.93	9 07 28.5 ["] 124.2	3 52.3	7.36	1.196 310	22 23 54
6	15 17 30.81 ^s 45.87	+0 56.93	- 9 09 42.1 ["] 133.6	-3 53.1	7.33	1.200 465	22 19 14
7	15 16 46.35 ^s 44.46	56.94	9 12 05.2 ["] -143.1	3 53.9	7.30	1.204 830	22 14 35
8	15 16 03.37 ^s 42.98	56.95	9 14 37.7 ["] 152.5	3 54.6	7.28	1.209 402	22 09 58
9	15 15 21.92 ^s 41.45	56.96	9 17 19.7 ["] 162.0	3 55.4	7.25	1.214 178	22 05 22
10	15 14 42.04 ^s 39.88	56.97	9 20 11.2 ["] 171.5	3 56.1	7.22	1.219 155	22 00 48
11	15 14 03.77 ^s 38.27	+0 56.99	- 9 23 12.0 ["] 180.8	-3 56.8	7.19	1.224 329	21 56 16
12*	15 13 27.17 ^s 36.60	57.00	9 26 22.1 ["] -190.1	3 57.5	7.16	1.229 696	21 51 45
13	15 12 52.27 ^s 34.90	57.01	9 29 41.5 ["] 199.4	3 58.2	7.12	1.235 253	21 47 16
14	15 12 19.10 ^s 33.17	57.02	9 33 10.0 ["] 208.5	3 58.8	7.09	1.240 997	21 42 49
15	15 11 47.69 ^s 31.41	57.02	9 36 47.5 ["] 217.5	3 59.4	7.06	1.246 922	21 38 23
16	15 11 18.08 ^s 29.61	+0 57.03	- 9 40 34.0 ["] 226.5	-3 59.9	7.02	1.253 027	21 34 00
17	15 10 50.28 ^s 27.80	57.04	9 44 29.2 ["] -235.2	4 00.4	6.99	1.259 306	21 29 38
18	15 10 24.31 ^s 25.97	57.04	9 48 33.1 ["] 243.9	4 00.8	6.95	1.265 756	21 25 18
19	15 10 00.19 ^s 24.12	57.06	9 52 45.5 ["] 252.4	4 01.1	6.92	1.272 373	21 20 59
20	15 09 37.94 ^s 22.25	57.07	9 57 06.3 ["] 260.8	4 01.5	6.88	1.279 154	21 16 43
21	15 09 17.56 ^s 20.38	+0 57.10	- 10 01 35.2 ["] 268.9	-4 01.9	6.84	1.286 096	21 12 28
22	15 08 59.05 ^s 18.51	57.12	10 06 12.2 ["] -277.0	4 02.2	6.80	1.293 195	21 08 16
23	15 08 42.44 ^s 16.61	57.15	10 10 57.1 ["] 284.9	4 02.5	6.77	1.300 447	21 04 05
24	15 08 27.72 ^s 14.72	57.17	10 15 49.7 ["] 292.6	4 02.8	6.73	1.307 851	20 59 56
25*	15 08 14.90 ^s 12.82	57.19	10 20 49.9 ["] 300.2	4 03.1	6.69	1.315 401	20 55 49
26	15 08 03.99 ^s 10.91	+0 57.21	- 10 25 57.6 ["] 307.7	-4 03.3	6.65	1.323 097	20 51 44
27	15 07 54.98 ^s 9.01	57.23	10 31 12.5 ["] -314.9	4 03.5	6.61	1.330 933	20 47 41
28	15 07 47.88 ^s 7.10	57.25	10 36 34.6 ["] 322.1	4 03.6	6.57	1.338 909	20 43 40
29	15 07 42.69 ^s 5.19	57.26	10 42 03.7 ["] 329.1	4 03.6	6.53	1.347 019	20 39 40
30	15 07 39.42 ^s 3.27	57.28	10 47 39.6 ["] 335.9	4 03.7	6.49	1.355 262	20 35 43
July 1	15 07 38.04 ^s 1.38	+0 57.30	- 10 53 22.3 ["] 342.7	-4 03.6	6.45	1.363 634	20 31 47
2	15 07 38.58 ^s 0.54	+0 57.32	- 10 59 11.5 ["] 349.2	-4 03.6	6.41	1.372 132	20 27 53

Photographic Magnitude : May 30, 6.2 ; June 19, 6.4

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
July	^{h m s} 15 07 38.04	^{m s} +0 57.30	^{° ' "} -10 53 22.3	["] -4 03.6	6.45	1.363 634	^{h m s} 20 31 47
	15 07 38.58	57.32	10 59 11.5	4 03.6	6.41	.372 132	20 27 53
	15 07 41.01	57.34	11 05 07.1	4 03.5	6.37	.380 753	20 24 02
	15 07 45.35	57.37	11 11 09.0	4 03.4	6.33	.389 493	20 20 12
	15 07 51.57	57.40	11 17 16.9	4 03.2	6.29	.398 350	20 16 23
	15 07 59.67	+0 57.43	-11 23 30.8	-4 03.1	6.25	1.407 320	20 12 37
	15 08 09.65	57.47	11 29 50.5	4 02.9	6.21	.416 400	20 08 53
	15 08 21.50	57.50	11 36 15.7	4 02.7	6.17	.425 587	20 05 10
	15 08 35.20	57.54	11 42 46.5	4 02.5	6.13	.434 877	20 01 30
	15 08 50.75	57.57	11 49 22.4	4 02.3	6.09	.444 267	19 57 51
	15 09 08.13	+0 57.60	-11 56 03.5	-4 02.0	6.05	1.453 755	19 54 14
	15 09 27.32	57.63	12 02 49.5	4 01.6	6.01	.463 336	19 50 38
	15 09 48.30	57.66	12 09 40.3	4 01.2	5.97	.473 007	19 47 05
	15 10 11.07	57.69	12 16 35.6	4 00.8	5.93	.482 765	19 43 33
	15 10 35.59	57.72	12 23 35.2	4 00.3	5.90	.492 608	19 40 03
	15 11 01.86	+0 57.76	-12 30 39.0	-3 59.8	5.86	1.502 532	19 36 34
	15 11 29.84	57.80	12 37 46.8	3 59.2	5.82	.512 534	19 33 08
	15 11 59.52	57.84	12 44 58.3	3 58.6	5.78	.522 613	19 29 43
	15 12 30.88	57.89	12 52 13.5	3 58.1	5.74	.532 764	19 26 20
	15 13 03.89	57.94	12 59 32.1	3 57.5	5.70	.542 987	19 22 58
	15 13 38.54	+0 57.98	-13 06 53.9	-3 56.9	5.67	1.553 279	19 19 38
	15 14 14.80	58.03	13 14 18.9	3 56.3	5.63	.563 638	19 16 19
	15 14 52.65	58.08	13 21 46.7	3 55.6	5.59	.574 062	19 13 02
	15 15 32.08	58.12	13 29 17.4	3 54.9	5.55	.584 548	19 09 47
	15 16 13.07	58.16	13 36 50.7	3 54.1	5.52	.595 095	19 06 33
	15 16 55.60	+0 58.20	-13 44 26.4	-3 53.3	5.48	1.605 702	19 03 21
	15 17 39.65	58.24	13 52 04.5	3 52.5	5.44	.616 365	19 00 10
	15 18 25.20	58.28	13 59 44.8	3 51.6	5.41	.627 083	18 57 00
	15 19 12.25	58.32	14 07 27.1	3 50.6	5.37	.637 854	18 53 53
	15 20 00.76	58.37	14 15 11.4	3 49.7	5.34	.648 677	18 50 46
	15 20 50.74	+0 58.42	-14 22 57.4	-3 48.7	5.30	1.659 548	18 47 41
Aug.	15 21 42.15	58.47	14 30 45.1	3 47.7	5.27	.670 467	18 44 38
	15 22 34.98	58.53	14 38 34.2	3 46.7	5.23	.681 431	18 41 35
	15 23 29.23	58.59	14 46 24.7	3 45.6	5.20	.692 437	18 38 35
	15 24 24.87	58.65	14 54 16.5	3 44.6	5.17	.703 485	18 35 35
	15 25 21.88	+0 58.71	-15 02 09.3	-3 43.5	5.13	1.714 572	18 32 37
	15 26 20.26	58.76	15 10 03.1	3 42.5	5.10	.725 696	18 29 40
	15 27 19.98	58.82	15 17 57.8	3 41.3	5.07	.736 855	18 26 45
	15 28 21.03	58.87	15 25 53.1	3 40.2	5.03	.748 046	18 23 51
	15 29 23.39	58.92	15 33 48.9	3 38.9	5.00	.759 267	18 20 58
	15 30 27.04	+0 58.97	-15 41 45.1	-3 37.7	4.97	1.770 517	18 18 06
	15 31 31.96	59.02	15 49 41.5	3 36.3	4.94	.781 793	18 15 16
	15 32 38.14	59.08	15 57 37.9	3 35.0	4.91	.793 093	18 12 27
	15 33 45.55	59.14	16 05 34.4	3 33.6	4.88	.804 415	18 09 39
	15 34 54.17	59.20	16 13 30.6	3 32.2	4.85	.815 759	18 06 53
	15 36 04.00	+0 59.27	-16 21 26.4	-3 30.8	4.82	1.827 122	18 04 07
	15 37 15.00	+0 59.34	-16 29 21.7	-3 29.4	4.79	1.838 503	18 01 23

Photographic Magnitude : July 9, 6.7 ; July 29, 7.0

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephem- eris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Aug. 16	15 37 15.00 ⁺	+0 59.34	-16 29 21.7	-3 29.4	4.79	1.838 503	18 01 23
17	15 38 27.16 ⁺	59.41	16 37 16.4	3 28.0	4.76	.849 901	17 58 40
18	15 39 40.46	59.48	16 45 10.4	3 26.5	4.73	.861 314	17 55 58
19*	15 40 54.89	59.54	16 53 03.4	3 25.0	4.70	.872 742	17 53 17
20	15 42 10.43	59.60	17 00 55.5	3 23.5	4.67	.884 183	17 50 37
21	15 43 27.07 ⁺	+0 59.66	-17 08 46.4	-3 22.0	4.64	1.895 636	17 47 58
22	15 44 44.79 ⁺	59.72	17 16 36.0	3 20.4	4.61	.907 100	17 45 20
23	15 46 03.59	59.78	17 24 24.3	3 18.7	4.59	.918 574	17 42 44
24	15 47 23.43	59.84	17 32 11.1	3 17.0	4.56	.930 057	17 40 08
25	15 48 44.32	59.90	17 39 56.3	3 15.3	4.53	.941 548	17 37 34
26	15 50 06.25 ⁺	+0 59.96	-17 47 39.9	-3 13.5	4.51	1.953 045	17 35 00
27	15 51 29.19 ⁺	1 00.02	17 55 21.6	3 11.7	4.48	.964 548	17 32 28
28	15 52 53.15	00.09	18 03 01.5	3 09.9	4.45	.976 055	17 29 56
29	15 54 18.10	00.16	18 10 39.3	3 08.1	4.43	.987 565	17 27 26
30	15 55 44.03	00.23	18 18 15.1	3 06.3	4.40	1.999 078	17 24 56
31	15 57 10.95 ⁺	+1 00.31	-18 25 48.6	-3 04.4	4.38	2.010 590	17 22 27
Sept. 1	15 58 38.83 ⁺	00.38	18 33 19.8	3 02.6	4.35	.022 102	17 20 00
2	16 00 07.67	00.45	18 40 48.6	3 00.7	4.33	.033 612	17 17 33
3*	16 01 37.45	00.52	18 48 14.8	2 58.8	4.30	.045 118	17 15 07
4	16 03 08.16	00.59	18 55 38.4	2 56.9	4.28	.056 619	17 12 42
5	16 04 39.80 ⁺	+1 00.65	-19 02 59.3	-2 54.9	4.26	2.068 113	17 10 18
6	16 06 12.35 ⁺	00.71	19 10 17.2	2 52.9	4.23	.079 600	17 07 55
7	16 07 45.79	00.77	19 17 32.3	2 50.8	4.21	.091 076	17 05 33
8	16 09 20.12	00.84	19 24 44.2	2 48.6	4.19	.102 542	17 03 12
9	16 10 55.32	00.90	19 31 52.9	2 46.5	4.16	.113 994	17 00 51
10	16 12 31.38 ⁺	+1 00.98	-19 38 58.3	-2 44.3	4.14	2.125 434	16 58 32
11	16 14 08.27 ⁺	01.05	19 46 00.3	2 42.1	4.12	.136 858	16 56 13
12	16 15 46.00	01.13	19 52 58.7	2 39.9	4.10	.148 267	16 53 55
13	16 17 24.55	01.20	19 59 53.5	2 37.7	4.07	.159 658	16 51 38
14	16 19 03.89	01.28	20 06 44.6	2 35.5	4.05	.171 033	16 49 21
15	16 20 44.03 ⁺	+1 01.35	-20 13 31.8	-2 33.3	4.03	2.182 389	16 47 06
16*	16 22 24.95 ⁺	01.42	20 20 15.1	2 31.0	4.01	.193 726	16 44 51
17	16 24 06.64	01.48	20 26 54.3	2 28.7	3.99	.205 044	16 42 37
18	16 25 49.09	01.54	20 33 29.5	2 26.4	3.97	.216 341	16 40 24
19	16 27 32.28	01.60	20 40 00.4	2 24.0	3.95	.227 617	16 38 11
20	16 29 16.22 ⁺	+1 01.66	-20 46 27.0	-2 21.6	3.93	2.238 872	16 35 59
21	16 31 00.89 ⁺	01.72	20 52 49.3	2 19.2	3.91	.250 104	16 33 48
22	16 32 46.27	01.78	20 59 07.1	2 16.7	3.89	.261 313	16 31 38
23	16 34 32.37	01.84	21 05 20.3	2 14.1	3.87	.272 499	16 29 28
24	16 36 19.18	01.91	21 11 28.9	2 11.6	3.85	.283 660	16 27 19
25	16 38 06.68 ⁺	+1 01.98	-21 17 32.9	-2 09.0	3.83	2.294 795	16 25 11
26	16 39 54.87 ⁺	02.05	21 23 32.0	2 06.5	3.82	.305 904	16 23 03
27	16 41 43.75	02.12	21 29 26.3	2 03.9	3.80	.316 985	16 20 56
28	16 43 33.29	02.19	21 35 15.6	2 01.3	3.78	.328 039	16 18 50
29	16 45 23.50	02.25	21 40 59.9	1 58.8	3.76	.339 063	16 16 44
30	16 47 14.37 ⁺	+1 02.32	-21 46 39.1	-1 56.2	3.74	2.350 057	16 14 39
Oct. 1*	16 49 05.88 ⁺	+1 02.38	-21 52 13.1	-1 53.5	3.73	2.361 020	16 12 35

Photographic Magnitude : Aug. 18, 7.2 ; Sept. 7, 7.5 ; Sept. 27, 7.7

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

VESTA, 1967

FOR 0^h EPHEMERIS TIME

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Date	Right Ascension		Declination		Hor. Par.	True Distance	Ephemeris Transit
	Astrometric 1950.0	App. -Astr.	Astrometric 1950.0	App. -Astr.			
	^h ^m ^s	^m ^s	[°] ['] ["]	['] ["]	["]		^h ^m ^s
Oct. 1*	16 49 05.88 ^s	+1 02.38	-21 52 13.1	-1 53.5	3.73	2.361 020	16 12 35
2	16 50 58.04 ^s	02.43	21 57 41.8	1 50.9	3.71	.371 950	16 10 31
3	16 52 50.83 ^s	02.49	22 03 05.2	1 48.2	3.69	.382 847	16 08 28
4	16 54 44.25 ^s	02.54	22 08 23.2	1 45.4	3.68	.393 708	16 06 25
5	16 56 38.28 ^s	02.59	22 13 35.7	1 42.6	3.66	.404 533	16 04 24
6	16 58 32.90 ^s	+1 02.64	-22 18 42.5	-1 39.8	3.64	2.415 320	16 02 22
7	17 00 28.12 ^s	02.70	22 23 43.7	1 36.9	3.63	.426 069	16 00 22
8	17 02 23.92 ^s	02.76	22 28 39.2	1 34.1	3.61	.436 777	15 58 21
9	17 04 20.29 ^s	02.83	22 33 28.8	1 31.2	3.60	.447 445	15 56 22
10	17 06 17.21 ^s	02.89	22 38 12.6	1 28.4	3.58	.458 072	15 54 23
11	17 08 14.68 ^s	+1 02.95	-22 42 50.3	-1 25.5	3.56	2.468 657	15 52 24
12	17 10 12.68 ^s	03.01	22 47 22.0	1 22.6	3.55	.479 198	15 50 26
13	17 12 11.20 ^s	03.06	22 51 47.7	1 19.8	3.53	.489 697	15 48 29
14	17 14 10.23 ^s	03.10	22 56 07.1	1 16.9	3.52	.500 152	15 46 32
15*	17 16 09.77 ^s	03.15	23 00 20.3	1 13.9	3.51	.510 562	15 44 35
16	17 18 09.80 ^s	+1 03.18	-23 04 27.2	-1 10.9	3.49	2.520 928	15 42 39
17	17 20 10.32 ^s	03.22	23 08 27.8	1 07.9	3.48	.531 248	15 40 44
18	17 22 11.31 ^s	03.26	23 12 21.9	1 04.9	3.46	.541 523	15 38 49
19	17 24 12.78 ^s	03.30	23 16 09.6	1 01.8	3.45	.551 751	15 36 54
20	17 26 14.70 ^s	03.34	23 19 50.8	0 58.7	3.43	.561 932	15 35 00
21	17 28 17.07 ^s	+1 03.38	-23 23 25.4	-0 55.6	3.42	2.572 066	15 33 06
22	17 30 19.89 ^s	03.42	23 26 53.4	0 52.5	3.41	.582 152	15 31 13
23	17 32 23.15 ^s	03.46	23 30 14.7	0 49.4	3.39	.592 189	15 29 20
24	17 34 26.83 ^s	03.50	23 33 29.4	0 46.3	3.38	.602 176	15 27 28
25	17 36 30.93 ^s	03.54	23 36 37.2	0 43.2	3.37	.612 114	15 25 36
26	17 38 35.45 ^s	+1 03.58	-23 39 38.3	-0 40.1	3.36	2.622 000	15 23 44
27	17 40 40.38 ^s	03.62	23 42 32.5	0 36.9	3.34	.631 835	15 21 53
28	17 42 45.71 ^s	03.65	23 45 19.7	0 33.8	3.33	.641 616	15 20 02
29	17 44 51.42 ^s	03.68	23 48 00.1	0 30.7	3.32	.651 345	15 18 12
30*	17 46 57.52 ^s	03.70	23 50 33.4	0 27.5	3.31	.661 018	15 16 22
31	17 49 04.00 ^s	+1 03.72	-23 52 59.8	-0 24.3	3.30	2.670 636	15 14 32
Nov. 1	17 51 10.84 ^s	03.73	23 55 19.0	0 21.1	3.28	.680 196	15 12 43
2	17 53 18.04 ^s	03.75	23 57 31.1	0 17.8	3.27	.689 699	15 10 54
3	17 55 25.58 ^s	03.77	23 59 36.1	0 14.5	3.26	.699 142	15 09 05
4	17 57 33.46 ^s	03.80	24 01 33.8	0 11.2	3.25	.708 525	15 07 17
5	17 59 41.67 ^s	+1 03.83	-24 03 24.3	-0 07.9	3.24	2.717 847	15 05 29
6	18 01 50.18 ^s	03.85	24 05 07.5	0 04.6	3.23	.727 107	15 03 41
7	18 03 59.00 ^s	03.88	24 06 43.5	0 01.4	3.22	.736 304	15 01 54
8	18 06 08.11 ^s	03.89	24 08 12.1	+0 01.9	3.21	.745 438	15 00 06
9	18 08 17.50 ^s	03.91	24 09 33.3	0 05.1	3.19	.754 508	14 58 20
10	18 10 27.15 ^s	+1 03.92	-24 10 47.2	+0 08.4	3.18	2.763 514	14 56 33
11	18 12 37.07 ^s	03.92	24 11 53.6	0 11.6	3.17	.772 455	14 54 47
12*	18 14 47.23 ^s	03.92	24 12 52.7	0 14.9	3.16	.781 332	14 53 01
13	18 16 57.64 ^s	03.92	24 13 44.2	0 18.2	3.15	.790 142	14 51 15
14	18 19 08.28 ^s	03.91	24 14 28.4	0 21.6	3.14	.798 887	14 49 29
15	18 21 19.14 ^s	+1 03.91	-24 15 05.0	+0 24.9	3.13	2.807 566	14 47 44
16	18 23 30.21 ^s	+1 03.90	-24 15 34.2	+0 28.3	3.12	2.816 178	14 45 58

Photographic Magnitude : Oct. 17, 7.9 ; Nov. 6, 8.1 ; Nov. 26, 8.2

* On the dates so indicated the lunar inequality is a maximum in Right Ascension.

FOR 0^h EPHEMERIS TIME

Date	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>dψ</i>	<i>dε</i>	<i>τ</i>	S.T.
					(0 ^s .0001)	(0 [″] .001)			^h
Jan. 0	— 4.447	—6.166	— 2.885	+20.212	—16	+214	+ 9	—0.0028	6.6
1	4.381	6.229	3.214	20.155	16	+184	+ 60	— .0001	6.7
2	4.335	6.278	3.542	20.091	16	+106	+ 96	+ .0026	6.7
3	4.299	6.303	3.870	20.021	16	+ 3	+108	.0054	6.8
4	4.262	6.305	4.196	19.945	16	— 98	+ 96	.0081	6.9
5	— 4.214	—6.285	— 4.522	+19.862	—16	—169	+ 61	+0.0108	6.9
6	4.148	6.252	4.847	19.772	16	—195	+ 13	.0136	7.0
7	4.061	6.219	5.170	19.676	16	—167	— 36	.0163	7.1
8	3.956	6.196	5.492	19.574	16	— 94	— 76	.0191	7.1
9	3.841	6.192	5.812	19.465	16	+ 6	— 97	.0218	7.2
10	— 3.725	—6.210	— 6.130	+19.349	—16	+111	— 97	+0.0245	7.3
11	3.616	6.248	6.446	19.226	15	+198	— 77	.0273	7.3
12	3.521	6.302	6.760	19.097	15	+251	— 42	.0300	7.4
13	3.443	6.362	7.072	18.962	15	+261	— 1	.0327	7.5
14	3.384	6.423	7.381	18.821	15	+226	+ 40	.0355	7.5
15	— 3.339	—6.475	— 7.688	+18.673	—15	+157	+ 72	+0.0382	7.6
16	3.304	6.516	7.991	18.519	15	+ 62	+ 92	.0410	7.6
17	3.275	6.540	8.292	18.360	15	— 43	+ 95	.0437	7.7
18	3.244	6.548	8.590	18.195	16	—144	+ 82	.0464	7.8
19	3.205	6.541	8.884	18.024	16	—224	+ 53	.0492	7.8
20	— 3.154	—6.526	— 9.176	+17.848	—16	—273	+ 15	+0.0519	7.9
21	3.088	6.504	9.464	17.667	16	—280	— 29	.0546	8.0
22	3.003	6.487	9.749	17.480	15	—242	— 69	.0574	8.0
23	2.903	6.482	10.031	17.288	15	—162	— 98	.0601	8.1
24	2.792	6.494	10.310	17.091	15	— 53	—109	.0629	8.2
25	— 2.679	—6.531	—10.585	+16.889	—15	+ 63	— 96	+0.0656	8.2
26	2.574	6.591	10.857	16.683	15	+159	— 60	.0683	8.3
27	2.488	6.667	11.126	16.472	15	+210	— 9	.0711	8.4
28	2.425	6.746	11.391	16.256	15	+203	+ 46	.0738	8.4
29	2.386	6.815	11.653	16.035	15	+140	+ 90	.0766	8.5
30	— 2.361	—6.860	—11.912	+15.809	—15	+ 41	+110	+0.0793	8.6
31	2.339	6.878	12.168	15.578	15	— 63	+103	.0820	8.6
Feb. 1	2.308	6.872	12.420	15.342	15	—142	+ 72	.0848	8.7
2	2.259	6.851	12.668	15.101	15	—177	+ 26	.0875	8.8
3	2.191	6.826	12.913	14.856	15	—161	— 24	.0902	8.8
4	— 2.106	—6.808	—13.154	+14.605	—15	— 99	— 67	+0.0930	8.9
5	2.008	6.807	13.391	14.349	15	— 6	— 93	.0957	9.0
6	1.909	6.827	13.623	14.089	14	+ 95	— 98	.0985	9.0
7	1.814	6.866	13.851	13.824	14	+185	— 84	.1012	9.1
8	1.732	6.922	14.075	13.554	14	+245	— 53	.1039	9.2
9	— 1.665	—6.987	—14.294	+13.280	—14	+267	— 13	+0.1067	9.2
10	1.617	7.053	14.508	13.001	14	+245	+ 29	.1094	9.3
11	1.585	7.113	14.717	12.719	14	+183	+ 64	.1121	9.4
12	1.564	7.161	14.921	12.432	14	+ 94	+ 88	.1149	9.4
13	1.551	7.193	15.120	12.141	15	— 11	+ 96	.1176	9.5
14	— 1.537	—7.208	—15.314	+11.847	—15	—114	+ 87	+0.1204	9.6
15	— 1.519	—7.209	—15.503	+11.549	—15	—203	+ 64	+0.1231	9.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
			^h ^m ^s	^h ^m ^s	^h ^m ^s	^h ^m ^s	(0 ^h .0001)	(0 ^h .001)	^h ^m
Jan. 0	^s -0.6836	^h 7.602	15 36 48	^h 20.417	23 27 30	^h -1.251	+131	86	23 36
1	.6735	7.615	15 39 31	20.410	23 23 46	1.394	+113	95	21 23
2	.6664	7.629	15 41 30	20.401	23 20 00	1.536	+ 65	105	19 35
3	.6609	7.629	15 42 49	20.392	23 16 14	1.678	+ 2	108	18 02
4	.6553	7.610	15 43 46	20.382	23 12 28	1.820	- 60	104	16 32
5	-0.6479	7.567	15 44 38	20.370	23 08 42	-1.961	-103	91	14 49
6	.6378	7.503	15 45 45	20.357	23 04 54	2.102	-119	79	12 38
7	.6244	7.427	15 47 25	20.344	23 01 07	2.242	-102	76	10 06
8	.6084	7.351	15 49 46	20.330	22 57 19	2.382	- 57	85	7 45
9	.5907	7.287	15 52 45	20.314	22 53 30	2.520	+ 4	97	5 55
10	-0.5728	7.242	15 56 10	20.297	22 49 41	-2.658	+ 68	107	4 22
11	.5561	7.219	15 59 46	20.278	22 45 52	2.795	+121	110	2 57
12	.5415	7.219	16 03 14	20.258	22 42 02	2.931	+154	108	1 31
13	.5296	7.234	16 06 19	20.238	22 38 11	3.067	+160	104	0 02
14	.5205	7.260	16 08 52	20.217	22 34 21	3.201	+138	98	22 24
15	-0.5136	7.285	16 10 53	20.194	22 30 29	-3.334	+ 96	95	20 44
16	.5083	7.306	16 12 27	20.170	22 26 38	3.465	+ 38	95	19 00
17	.5038	7.314	16 13 36	20.146	22 22 47	3.596	- 26	97	17 19
18	.4990	7.308	16 14 35	20.121	22 18 55	3.725	- 88	100	15 40
19	.4931	7.284	16 15 35	20.095	22 15 03	3.852	-137	104	14 03
20	-0.4853	7.248	16 16 49	20.069	22 11 10	-3.979	-167	110	12 31
21	.4751	7.200	16 18 25	20.042	22 07 17	4.104	-171	115	11 02
22	.4622	7.148	16 20 38	20.015	22 03 24	4.228	-148	119	9 37
23	.4468	7.102	16 23 30	19.987	21 59 30	4.350	- 99	117	8 13
24	.4297	7.069	16 26 56	19.960	21 55 36	4.471	- 32	111	6 44
25	-0.4123	7.059	16 30 47	19.932	21 51 42	-4.590	+ 39	99	5 02
26	.3963	7.076	16 34 40	19.905	21 47 47	4.708	+ 97	87	2 54
27	.3830	7.116	16 38 09	19.878	21 43 51	4.825	+128	84	0 25
28	.3734	7.169	16 40 55	19.850	21 39 55	4.940	+124	93	22 01
29	.3674	7.221	16 42 49	19.822	21 35 59	5.053	+ 86	106	20 07
30	-0.3635	7.255	16 44 02	19.794	21 32 01	-5.166	+ 25	111	18 34
31	.3602	7.265	16 44 52	19.767	21 28 02	5.277	- 39	106	17 05
Feb. 1	.3554	7.249	16 45 44	19.739	21 24 02	5.386	- 87	91	15 28
2	.3480	7.214	16 47 00	19.711	21 20 02	5.493	-108	75	13 21
3	.3375	7.169	16 48 49	19.684	21 16 01	5.600	- 98	68	10 38
4	-0.3244	7.126	16 51 15	19.655	21 11 58	-5.704	- 61	78	8 02
5	.3095	7.097	16 54 16	19.627	21 07 55	5.807	- 4	93	6 06
6	.2942	7.089	16 57 31	19.598	21 03 51	5.908	+ 58	105	4 36
7	.2796	7.102	17 00 48	19.569	20 59 47	6.006	+113	112	3 15
8	.2670	7.135	17 03 49	19.540	20 55 41	6.104	+150	111	1 54
9	-0.2568	7.183	17 06 23	19.511	20 51 34	-6.198	+163	107	0 28
10	.2494	7.236	17 08 21	19.481	20 47 27	6.291	+150	102	22 54
11	.2445	7.287	17 09 45	19.452	20 43 20	6.382	+112	97	21 15
12	.2414	7.330	17 10 43	19.421	20 39 12	6.470	+ 57	96	19 32
13	.2394	7.358	17 11 20	19.391	20 35 03	6.557	- 7	96	17 50
14	-0.2372	7.370	17 11 51	19.362	20 30 54	-6.641	- 70	98	16 10
15	-0.2344	7.367	17 12 24	19.332	20 26 44	-6.723	-124	103	14 34

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ["] .001)			^h
Feb. 15	- 1.519	-7.209	-15.503	+11.549	-15	-203	+ 64	+0.1231	9.6
16	1.489	7.197	15.686	11.248	15	-263	+ 28	.1258	9.7
17	1.446	7.178	15.865	10.944	15	-286	- 14	.1286	9.8
18	1.386	7.159	16.038	10.637	15	-267	- 55	.1313	9.8
19	1.310	7.148	16.206	10.327	15	-207	- 89	.1340	9.9
20	- 1.222	-7.151	-16.369	+10.014	-15	-113	-108	+0.1368	9.9
21	1.127	7.176	16.526	9.699	15	- 1	-105	.1395	10.0
22	1.034	7.224	16.678	9.382	14	+105	- 78	.1423	10.1
23	0.956	7.292	16.826	9.062	14	+178	- 31	.1450	10.1
24	0.898	7.368	16.968	8.739	14	+198	+ 25	.1477	10.2
25	- 0.866	-7.440	-17.106	+ 8.415	-14	+158	+ 77	+0.1505	10.3
26	0.852	7.491	17.239	8.088	15	+ 71	+108	.1532	10.3
27	0.847	7.514	17.367	7.759	15	- 36	+112	.1559	10.4
28	0.836	7.508	17.489	7.428	15	-126	+ 87	.1587	10.5
Mar. 1	0.807	7.480	17.607	7.094	15	-173	+ 41	.1614	10.5
2	- 0.758	-7.445	-17.720	+ 6.758	-15	-166	- 11	+0.1642	10.6
3	0.689	7.415	17.827	6.419	15	-108	- 58	.1669	10.7
4	0.607	7.401	17.929	6.079	15	- 15	- 89	.1696	10.7
5	0.520	7.406	18.026	5.736	15	+ 89	- 99	.1724	10.8
6	0.438	7.433	18.117	5.392	15	+183	- 88	.1751	10.9
7	- 0.366	-7.474	-18.202	+ 5.045	-15	+250	- 61	+0.1779	10.9
8	0.309	7.526	18.281	4.697	15	+280	- 23	.1806	11.0
9	0.270	7.582	18.355	4.347	15	+268	+ 19	.1833	11.1
10	0.247	7.633	18.422	3.996	15	+215	+ 57	.1861	11.1
11	0.237	7.672	18.484	3.644	15	+131	+ 84	.1888	11.2
12	- 0.235	-7.696	-18.539	+ 3.291	-15	+ 28	+ 97	+0.1915	11.3
13	0.234	7.703	18.589	2.937	15	- 78	+ 93	.1943	11.3
14	0.228	7.693	18.632	2.582	16	-173	+ 73	.1970	11.4
15	0.213	7.670	18.670	2.227	16	-242	+ 40	.1998	11.5
16	0.184	7.638	18.702	1.872	16	-278	- 1	.2025	11.5
17	- 0.139	-7.604	-18.728	+ 1.517	-16	-273	- 43	+0.2052	11.6
18	0.079	7.576	18.748	1.161	16	-229	- 79	.2080	11.7
19	- 0.006	7.559	18.762	0.806	16	-151	-103	.2107	11.7
20	+ 0.076	7.560	18.771	0.451	16	- 51	-108	.2134	11.8
21	0.160	7.582	18.774	+ 0.096	16	+ 51	- 91	.2162	11.9
22	+ 0.235	-7.625	-18.772	- 0.258	-15	+134	- 53	+0.2189	11.9
23	0.294	7.683	18.764	0.611	15	+175	0	.2217	12.0
24	0.330	7.741	18.750	0.963	16	+159	+ 55	.2244	12.1
25	0.346	7.787	18.732	1.315	16	+ 90	+ 98	.2271	12.1
26	0.348	7.806	18.708	1.666	16	- 12	+115	.2299	12.2
27	+ 0.350	-7.794	-18.680	- 2.016	-16	-114	+101	+0.2326	12.2
28	0.366	7.756	18.646	2.366	16	-181	+ 62	.2353	12.3
29	0.406	7.702	18.607	2.715	16	-190	+ 8	.2381	12.4
30	0.468	7.649	18.563	3.064	16	-141	- 45	.2408	12.4
31	0.549	7.609	18.513	3.411	16	- 48	- 84	.2436	12.5
Apr. 1	+ 0.637	-7.592	-18.458	- 3.758	-16	+ 65	-100	+0.2463	12.6
2	+ 0.724	-7.596	-18.397	- 4.104	-16	+172	- 94	+0.2490	12.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Feb. 15	-0.2344	7.367	17 12 24	19.332	20 26 44	-6.723	-124	103	14 34
16	.2299	7.349	17 13 15	19.302	20 22 34	6.802	-161	109	12 59
17	.2232	7.322	17 14 26	19.273	20 18 24	6.880	-175	114	11 32
18	.2140	7.292	17 16 10	19.245	20 14 13	6.955	-163	120	10 10
19	.2024	7.267	17 18 27	19.217	20 10 01	7.028	-127	121	8 51
20	-0.1888	7.255	17 21 13	19.189	20 05 50	-7.098	- 69	117	7 30
21	.1742	7.264	17 24 18	19.162	20 01 38	7.166	- 1	105	6 01
22	.1601	7.298	17 27 25	19.136	19 57 26	7.232	+ 64	89	4 07
23	.1480	7.354	17 30 07	19.111	19 53 13	7.296	+109	77	1 35
24	.1392	7.423	17 32 12	19.086	19 49 00	7.358	+121	83	22 49
25	-0.1342	7.490	17 33 27	19.064	19 44 46	-7.418	+ 97	99	20 37
26	.1322	7.539	17 34 03	19.042	19 40 32	7.476	+ 43	112	18 59
27	.1314	7.562	17 34 16	19.022	19 36 18	7.531	- 22	113	17 31
28	.1296	7.554	17 34 35	19.001	19 32 03	7.584	- 77	100	16 00
Mar. 1	.1253	7.523	17 35 22	18.982	19 27 47	7.635	-106	80	14 03
2	-0.1178	7.483	17 36 45	18.965	19 23 30	-7.684	-102	67	11 22
3	.1072	7.447	17 38 46	18.947	19 19 12	7.731	- 66	72	8 26
4	.0945	7.426	17 41 15	18.931	19 14 55	7.775	- 9	89	6 15
5	.0812	7.424	17 43 56	18.917	19 10 36	7.817	+ 54	105	4 41
6	.0686	7.446	17 46 31	18.903	19 06 18	7.856	+112	114	3 22
7	-0.0576	7.483	17 48 47	18.888	19 01 58	-7.893	+153	117	2 06
8	.0489	7.532	17 50 36	18.875	18 57 38	7.927	+171	114	0 47
9	.0429	7.587	17 51 50	18.863	18 53 18	7.959	+164	108	23 20
10	.0394	7.637	17 52 35	18.850	18 48 57	7.989	+132	103	21 45
11	.0379	7.676	17 52 55	18.840	18 44 37	8.015	+ 80	99	20 08
12	-0.0375	7.700	17 53 00	18.829	18 40 16	-8.039	+ 17	98	18 26
13	.0374	7.706	17 53 02	18.820	18 35 55	8.061	- 48	98	16 46
14	.0365	7.696	17 53 12	18.810	18 31 34	8.080	-106	100	15 07
15	.0342	7.673	17 53 38	18.802	18 27 13	8.096	-148	104	13 30
16	.0299	7.640	17 54 29	18.795	18 22 52	8.110	-170	111	11 58
17	-0.0230	7.605	17 55 49	18.789	18 18 31	-8.121	-167	117	10 34
18	.0138	7.576	17 57 37	18.784	18 14 10	8.130	-140	121	9 16
19	- .0025	7.559	17 59 49	18.779	18 09 50	8.136	- 92	119	8 01
20	+ .0102	7.560	18 02 18	18.776	18 05 30	8.140	- 31	110	6 42
21	.0229	7.584	18 04 50	18.775	18 01 10	8.141	+ 31	93	5 10
22	+0.0345	7.629	18 07 04	18.774	17 56 51	-8.140	+ 82	75	2 59
23	.0435	7.689	18 08 46	18.774	17 52 32	8.137	+107	70	0 00
24	.0491	7.748	18 09 46	18.775	17 48 14	8.131	+ 97	84	21 16
25	.0514	7.795	18 10 10	18.778	17 43 56	8.123	+ 55	104	19 20
26	.0517	7.814	18 10 13	18.782	17 39 39	8.113	- 7	115	17 51
27	+0.0521	7.802	18 10 17	18.789	17 35 22	-8.100	- 70	111	16 23
28	.0545	7.765	18 10 48	18.796	17 31 04	8.086	-111	95	14 43
29	.0606	7.713	18 12 04	18.804	17 26 48	8.069	-116	76	12 24
30	.0702	7.663	18 14 00	18.814	17 22 31	8.050	- 86	72	9 25
31	.0826	7.629	18 16 30	18.825	17 18 14	8.028	- 29	86	6 51
Apr. 1	+0.0962	7.619	18 19 11	18.837	17 13 58	-8.004	+ 40	103	5 02
2	+0.1095	7.630	18 21 47	18.849	17 09 42	-7.978	+105	116	3 36

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^h
Apr. 1	+ 0.637	-7.592	-18.458	- 3.758	-16	+ 65	-100	+0.2463	12.6
2	0.724	7.596	18.397	4.104	16	+172	- 94	.2490	12.6
3	0.800	7.617	18.332	4.449	16	+252	- 70	.2518	12.7
4	0.861	7.652	18.260	4.793	16	+293	- 32	.2545	12.8
5	0.905	7.690	18.183	5.136	16	+291	+ 10	.2573	12.8
6	+ 0.932	-7.724	-18.100	- 5.477	-16	+247	+ 49	+0.2600	12.9
7	0.946	7.750	18.012	5.817	16	+170	+ 80	.2627	13.0
8	0.952	7.762	17.917	6.155	16	+ 70	+ 97	.2655	13.0
9	0.956	7.756	17.818	6.490	16	- 37	+ 97	.2682	13.1
10	0.962	7.733	17.713	6.824	17	-137	+ 81	.2709	13.2
11	+ 0.978	-7.696	-17.602	- 7.155	-17	-215	+ 51	+0.2737	13.2
12	1.007	7.649	17.487	7.484	17	-259	+ 11	.2764	13.3
13	1.052	7.598	17.365	7.810	17	-266	- 32	.2792	13.4
14	1.113	7.551	17.239	8.133	17	-233	- 70	.2819	13.4
15	1.188	7.515	17.108	8.454	17	-165	- 97	.2846	13.5
16	+ 1.273	-7.496	-16.972	- 8.771	-17	- 75	-107	+0.2874	13.6
17	1.360	7.495	16.830	9.085	17	+ 21	- 98	.2901	13.6
18	1.443	7.516	16.685	9.397	16	+104	- 67	.2928	13.7
19	1.513	7.552	16.534	9.704	16	+154	- 21	.2956	13.8
20	1.564	7.595	16.379	10.009	16	+156	+ 33	.2983	13.8
21	+ 1.595	-7.632	-16.220	-10.310	-17	+105	+ 81	+0.3011	13.9
22	1.609	7.650	16.057	10.608	17	+ 12	+110	.3038	14.0
23	1.619	7.638	15.889	10.902	17	- 95	+110	.3065	14.0
24	1.638	7.597	15.717	11.193	17	-181	+ 81	.3093	14.1
25	1.676	7.535	15.541	11.481	17	-218	+ 31	.3120	14.2
26	+ 1.741	-7.466	-15.361	-11.766	-17	-190	- 26	+0.3147	14.2
27	1.828	7.406	15.177	12.048	17	-106	- 73	.3175	14.3
28	1.930	7.367	14.989	12.327	17	+ 11	-100	.3202	14.4
29	2.033	7.353	14.797	12.602	17	+132	-101	.3230	14.4
30	2.129	7.360	14.600	12.874	16	+232	- 81	.3257	14.5
May 1	+ 2.209	-7.383	-14.399	-13.143	-16	+292	- 45	+0.3284	14.5
2	2.272	7.411	14.194	13.408	16	+306	- 3	.3312	14.6
3	2.316	7.440	13.985	13.670	16	+275	+ 39	.3339	14.7
4	2.347	7.461	13.771	13.927	16	+205	+ 73	.3367	14.7
5	2.368	7.468	13.554	14.181	16	+110	+ 94	.3394	14.8
6	+ 2.384	-7.460	-13.332	-14.430	-17	+ 3	+ 99	+0.3421	14.9
7	2.403	7.434	13.106	14.676	17	-100	+ 87	.3449	14.9
8	2.430	7.394	12.877	14.916	17	-185	+ 60	.3476	15.0
9	2.469	7.343	12.643	15.152	17	-239	+ 22	.3503	15.1
10	2.524	7.287	12.406	15.384	17	-255	- 20	.3531	15.1
11	+ 2.596	-7.234	-12.165	-15.611	-17	-231	- 60	+0.3558	15.2
12	2.682	7.190	11.920	15.832	17	-170	- 91	.3586	15.3
13	2.780	7.163	11.672	16.049	17	- 83	-105	.3613	15.3
14	2.881	7.155	11.421	16.261	16	+ 11	-100	.3640	15.4
15	2.979	7.168	11.167	16.468	16	+ 96	- 75	.3668	15.5
16	+ 3.065	-7.196	-10.910	-16.669	-16	+151	- 34	+0.3695	15.5
17	+ 3.134	-7.235	-10.650	-16.866	-16	+161	+ 17	+0.3722	15.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Apr. 1	+0.0962	7.619	18 19 11	18.837	17 13 58	-8.004	+ 40	103	5 02
2	.1095	7.630	18 21 47	18.849	17 09 42	7.978	+105	116	3 36
3	.1211	7.659	18 23 59	18.864	17 05 26	7.950	+154	122	2 20
4	.1304	7.700	18 25 41	18.879	17 01 10	7.918	+179	121	1 01
5	.1372	7.743	18 26 51	18.895	16 56 55	7.885	+178	116	23 40
6	+0.1414	7.780	18 27 31	18.911	16 52 39	-7.849	+151	110	22 14
7	.1435	7.808	18 27 50	18.928	16 48 25	7.811	+104	105	20 41
8	.1444	7.820	18 27 58	18.945	16 44 10	7.770	+ 43	101	19 04
9	.1449	7.815	18 28 06	18.963	16 39 57	7.727	- 23	98	17 26
10	.1459	7.793	18 28 22	18.982	16 35 44	7.681	- 84	98	15 44
11	+0.1483	7.758	18 28 58	19.001	16 31 31	-7.633	-132	100	14 03
12	.1528	7.715	18 30 00	19.021	16 27 19	7.583	-158	104	12 24
13	.1596	7.670	18 31 32	19.040	16 23 08	7.530	-163	110	10 53
14	.1690	7.633	18 33 32	19.061	16 18 58	7.476	-143	116	9 32
15	.1806	7.608	18 35 56	19.083	16 14 49	7.419	-101	117	8 16
16	+0.1935	7.603	18 38 33	19.105	16 10 41	-7.360	- 46	111	7 02
17	.2069	7.617	18 41 08	19.125	16 06 33	7.298	+ 13	98	5 41
18	.2196	7.653	18 43 28	19.149	16 02 27	7.235	+ 64	79	3 53
19	.2304	7.702	18 45 19	19.171	15 58 22	7.170	+ 94	65	1 16
20	.2382	7.754	18 46 33	19.195	15 54 17	7.103	+ 95	70	22 08
21	+0.2430	7.797	18 47 13	19.219	15 50 14	-7.034	+ 64	91	19 49
22	.2452	7.817	18 47 31	19.245	15 46 12	6.963	+ 7	110	18 10
23	.2466	7.808	18 47 52	19.270	15 42 11	6.890	- 58	116	16 44
24	.2495	7.772	18 48 40	19.295	15 38 10	6.816	-111	109	15 13
25	.2553	7.719	18 50 10	19.322	15 34 11	6.739	-133	92	13 19
26	+0.2652	7.666	18 52 30	19.349	15 30 12	-6.661	-116	80	10 44
27	.2787	7.628	18 55 27	19.378	15 26 14	6.581	- 65	84	8 00
28	.2943	7.616	18 58 43	19.407	15 22 16	6.500	+ 7	100	5 50
29	.3101	7.629	19 01 49	19.436	15 18 19	6.417	+ 81	114	4 10
30	.3248	7.662	19 04 32	19.465	15 14 23	6.331	+142	123	2 45
May 1	+0.3371	7.706	19 06 38	19.495	15 10 27	-6.244	+179	125	1 25
2	.3468	7.751	19 08 10	19.525	15 06 32	6.155	+187	122	0 06
3	.3536	7.792	19 09 10	19.556	15 02 37	6.064	+168	116	22 42
4	.3583	7.822	19 09 51	19.586	14 58 42	5.972	+125	109	21 13
5	.3615	7.834	19 10 22	19.617	14 54 49	5.878	+ 67	104	19 40
6	+0.3640	7.832	19 10 53	19.646	14 50 56	-5.781	+ 2	99	18 03
7	.3669	7.813	19 11 39	19.676	14 47 03	5.683	- 61	96	16 22
8	.3709	7.783	19 12 46	19.705	14 43 13	5.584	-113	95	14 37
9	.3770	7.747	19 14 20	19.734	14 39 22	5.483	-146	97	12 52
10	.3854	7.712	19 16 25	19.763	14 35 32	5.380	-156	103	11 15
11	+0.3964	7.686	19 18 58	19.791	14 31 43	-5.275	-141	110	9 47
12	.4097	7.674	19 21 49	19.818	14 27 54	5.169	-104	113	8 26
13	.4247	7.684	19 24 51	19.845	14 24 06	5.061	- 51	110	7 10
14	.4402	7.713	19 27 44	19.871	14 20 20	4.953	+ 7	100	5 50
15	.4552	7.762	19 30 16	19.897	14 16 34	4.842	+ 59	84	4 12
16	+0.4685	7.822	19 32 17	19.922	14 12 49	-4.731	+ 92	69	1 58
17	+0.4791	7.885	19 33 41	19.947	14 09 05	-4.618	+ 98	66	23 01

BESSELIAN DAY NUMBERS, 1967

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 [″] .001)			
May 17	+ 3·134	-7·235	-10·650	-16·866	-16	+161	+ 17	+0·3722	15·6
18	3·185	7·271	10·388	17·057	16	+122	+ 65	·3750	15·7
19	3·218	7·294	10·123	17·243	16	+ 40	+100	·3777	15·7
20	3·243	7·294	9·856	17·424	16	- 65	+111	·3805	15·8
21	3·271	7·265	9·587	17·600	16	-164	+ 93	·3832	15·9
22	+ 3·314	-7·212	- 9·316	-17·771	-16	-225	+ 51	+0·3859	15·9
23	3·382	7·146	9·042	17·938	16	-227	- 4	·3887	16·0
24	3·474	7·083	8·766	18·099	16	-166	- 57	·3914	16·1
25	3·587	7·037	8·488	18·256	16	- 58	- 93	·3941	16·1
26	3·707	7·015	8·208	18·409	16	+ 70	-106	·3969	16·2
27	+ 3·823	-7·018	- 7·925	-18·556	-16	+186	- 93	+0·3996	16·3
28	3·926	7·042	7·640	18·699	15	+268	- 61	·4024	16·3
29	4·010	7·076	7·353	18·837	15	+303	- 18	·4051	16·4
30	4·076	7·112	7·064	18·970	15	+289	+ 26	·4078	16·5
31	4·125	7·143	6·772	19·098	15	+232	+ 64	·4106	16·5
June 1	+ 4·161	-7·162	- 6·479	-19·221	-15	+143	+ 90	+0·4133	16·6
2	4·192	7·164	6·183	19·338	15	+ 39	+ 99	·4161	16·7
3	4·222	7·151	5·885	19·450	16	- 67	+ 92	·4188	16·7
4	4·259	7·123	5·586	19·556	16	-157	+ 69	·4215	16·8
5	4·307	7·082	5·285	19·656	16	-221	+ 34	·4243	16·8
6	+ 4·369	-7·036	- 4·982	-19·751	-16	-248	- 8	+0·4270	16·9
7	4·449	6·990	4·678	19·840	15	-233	- 50	·4297	17·0
8	4·544	6·952	4·372	19·923	15	-179	- 84	·4325	17·0
9	4·652	6·930	4·065	20·000	15	- 95	-103	·4352	17·1
10	4·765	6·928	3·757	20·071	15	+ 2	-103	·4380	17·2
11	+ 4·876	-6·947	- 3·448	-20·136	-15	+ 93	- 82	+0·4407	17·2
12	4·976	6·983	3·138	20·195	15	+156	- 44	·4434	17·3
13	5·059	7·031	2·827	20·248	14	+177	+ 5	·4462	17·4
14	5·122	7·080	2·516	20·295	14	+148	+ 54	·4489	17·4
15	5·168	7·118	2·205	20·336	14	+ 74	+ 92	·4516	17·5
16	+ 5·203	-7·135	- 1·894	-20·371	-15	- 28	+108	+0·4544	17·6
17	5·237	7·128	1·583	20·401	15	-132	+ 99	·4571	17·6
18	5·282	7·096	1·271	20·425	15	-209	+ 65	·4599	17·7
19	5·347	7·048	0·960	20·444	15	-236	+ 15	·4626	17·8
20	5·436	6·998	0·649	20·458	14	-202	- 39	·4653	17·8
21	+ 5·547	-6·958	- 0·338	-20·466	-14	-114	- 82	+0·4681	17·9
22	5·670	6·941	- 0·027	20·469	14	+ 7	-104	·4708	18·0
23	5·795	6·949	+ 0·284	20·467	14	+130	-101	·4735	18·0
24	5·910	6·979	0·595	20·459	14	+229	- 76	·4763	18·1
25	6·008	7·026	0·906	20·446	13	+285	- 35	·4790	18·2
26	+ 6·086	-7·079	+ 1·217	-20·429	-13	+291	+ 11	+0·4818	18·2
27	6·145	7·128	1·528	20·405	13	+249	+ 52	·4845	18·3
28	6·189	7·166	1·839	20·376	13	+170	+ 83	·4872	18·4
29	6·224	7·190	2·149	20·342	13	+ 70	+ 98	·4900	18·4
30	6·257	7·197	2·459	20·302	13	- 37	+ 96	·4927	18·5
July 1	+ 6·293	-7·189	+ 2·769	-20·256	-14	-134	+ 78	+0·4955	18·6
2	+ 6·339	-7·166	+ 3·079	-20·204	-14	-207	+ 45	+0·4982	18·6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ^s .001)	^{h m}
May 17	+0.4791	7.885	19 33 41	19.947	14 09 05	-4.618	+ 98	66	23 01
18	.4868	7.938	19 34 37	19.971	14 05 22	4.505	+ 75	81	20 27
19	.4920	7.972	19 35 13	19.995	14 01 40	4.390	+ 24	101	18 36
20	.4957	7.982	19 35 53	20.018	13 57 59	4.274	- 40	114	17 08
21	.5000	7.967	19 36 57	20.042	13 54 19	4.157	-100	114	15 40
22	+0.5066	7.937	19 38 43	20.065	13 50 39	-4.040	-138	103	13 59
23	.5170	7.906	19 41 18	20.088	13 47 00	3.921	-139	90	11 50
24	.5312	7.889	19 44 30	20.110	13 43 22	3.801	-102	87	9 17
25	.5484	7.898	19 48 02	20.133	13 39 44	3.681	- 35	96	6 56
26	.5669	7.934	19 51 25	20.156	13 36 07	3.559	+ 43	110	5 01
27	+0.5847	7.992	19 54 19	20.178	13 32 30	-3.437	+114	119	3 26
28	.6005	8.062	19 56 33	20.200	13 28 54	3.313	+164	123	1 59
29	.6135	8.133	19 58 10	20.221	13 25 18	3.189	+185	122	0 34
30	.6236	8.197	19 59 16	20.243	13 21 42	3.063	+177	118	23 09
31	.6310	8.249	20 00 01	20.263	13 18 06	2.937	+142	112	21 41
June 1	+0.6366	8.283	20 00 37	20.284	13 14 31	-2.810	+ 87	106	20 09
2	.6413	8.300	20 01 20	20.302	13 10 55	2.681	+ 24	100	18 36
3	.6460	8.304	20 02 14	20.321	13 07 20	2.552	- 41	96	16 56
4	.6517	8.299	20 03 30	20.338	13 03 46	2.422	- 96	93	15 12
5	.6589	8.289	20 05 13	20.354	13 00 12	2.292	-135	94	13 25
6	+0.6686	8.282	20 07 21	20.370	12 56 37	-2.160	-152	99	11 41
7	.6808	8.286	20 09 54	20.384	12 53 04	2.029	-143	105	10 07
8	.6954	8.305	20 12 41	20.397	12 49 31	1.896	-109	110	8 41
9	.7119	8.347	20 15 29	20.409	12 45 57	1.763	- 58	110	7 20
10	.7293	8.408	20 18 05	20.420	12 42 25	1.629	+ 1	103	5 58
11	+0.7463	8.487	20 20 15	20.429	12 38 52	-1.495	+ 57	90	4 23
12	.7616	8.575	20 21 53	20.437	12 35 20	1.361	+ 95	76	2 21
13	.7744	8.662	20 22 57	20.444	12 31 48	1.226	+108	71	23 44
14	.7841	8.739	20 23 32	20.450	12 28 16	1.091	+ 91	80	21 10
15	.7912	8.796	20 23 55	20.455	12 24 45	0.956	+ 45	97	19 11
16	+0.7965	8.831	20 24 24	20.459	12 21 15	-0.821	- 17	109	17 37
17	.8017	8.845	20 25 13	20.462	12 17 45	0.686	- 81	112	16 08
18	.8086	8.846	20 26 39	20.464	12 14 15	0.551	-128	105	14 32
19	.8186	8.847	20 28 44	20.466	12 10 45	0.416	-144	95	12 36
20	.8322	8.861	20 31 21	20.468	12 07 16	0.281	-124	89	10 16
21	+0.8492	8.898	20 34 15	20.469	12 03 47	-0.147	- 70	94	7 56
22	.8682	8.962	20 36 59	20.469	12 00 18	-0.012	+ 4	104	5 54
23	.8874	9.048	20 39 18	20.469	11 56 49	+0.123	+ 80	113	4 12
24	.9051	9.145	20 41 02	20.468	11 53 20	0.258	+140	119	2 39
25	.9201	9.245	20 42 08	20.466	11 49 51	0.393	+174	119	1 09
26	+0.9320	9.335	20 42 45	20.465	11 46 22	+0.528	+178	116	23 38
27	.9411	9.411	20 43 03	20.462	11 42 52	0.663	+152	112	22 09
28	.9478	9.469	20 43 16	20.459	11 39 22	0.797	+104	107	20 37
29	.9532	9.510	20 43 31	20.455	11 35 53	0.932	+ 43	102	19 03
30	.9582	9.537	20 44 01	20.450	11 32 23	1.066	- 23	97	17 25
July 1	+0.9638	9.554	20 44 47	20.445	11 28 52	+1.201	- 82	94	15 43
2	+0.9708	9.567	20 45 59	20.437	11 25 20	+1.335	-127	94	13 55

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 [″] .001)			^h
July 1	-13.748	-7.189	+ 2.774	-20.255	-14	-134	+ 78	-0.5045	18.6
2	13.702	7.166	3.084	20.203	14	-207	+ 45	.5018	18.6
3	13.642	7.137	3.393	20.146	14	-244	+ 5	.4991	18.7
4	13.567	7.105	3.701	20.083	13	-242	- 38	.4963	18.8
5	13.476	7.080	4.008	20.014	13	-199	- 75	.4936	18.8
6	-13.371	-7.068	+ 4.315	-19.939	-13	-121	- 99	-0.4909	18.9
7	13.258	7.074	4.620	19.858	13	- 23	-106	.4881	19.0
8	13.145	7.104	4.924	19.771	13	+ 76	- 90	.4854	19.0
9	13.041	7.153	5.226	19.679	13	+153	- 55	.4826	19.1
10	12.954	7.216	5.527	19.580	12	+189	- 6	.4799	19.1
11	-12.887	-7.282	+ 5.825	-19.476	-12	+173	+ 45	-0.4772	19.2
12	12.840	7.338	6.122	19.365	12	+109	+ 86	.4744	19.3
13	12.807	7.375	6.417	19.250	12	+ 11	+107	.4717	19.3
14	12.778	7.387	6.710	19.129	13	- 95	+103	.4690	19.4
15	12.741	7.375	7.000	19.003	13	-181	+ 74	.4662	19.5
16	-12.687	-7.347	+ 7.288	-18.872	-13	-222	+ 29	-0.4635	19.5
17	12.610	7.312	7.574	18.736	13	-208	- 24	.4607	19.6
18	12.513	7.284	7.858	18.595	12	-140	- 70	.4580	19.7
19	12.401	7.273	8.139	18.449	12	- 34	- 99	.4553	19.7
20	12.284	7.286	8.418	18.299	12	+ 86	-105	.4525	19.8
21	-12.173	-7.324	+ 8.695	-18.144	-12	+192	- 86	-0.4498	19.9
22	12.077	7.378	8.970	17.984	12	+263	- 51	.4471	19.9
23	11.999	7.444	9.242	17.820	12	+287	- 5	.4443	20.0
24	11.942	7.508	9.512	17.651	12	+261	+ 39	.4416	20.1
25	11.902	7.563	9.780	17.477	12	+193	+ 74	.4388	20.1
26	-11.873	-7.605	+10.046	-17.299	-12	+ 98	+ 95	-0.4361	20.2
27	11.850	7.630	10.309	17.115	12	- 9	+ 99	.4334	20.3
28	11.824	7.637	10.570	16.927	12	-110	+ 85	.4306	20.3
29	11.792	7.629	10.828	16.734	12	-192	+ 56	.4279	20.4
30	11.747	7.612	11.083	16.536	12	-242	+ 18	.4252	20.5
31	-11.688	-7.591	+11.336	-16.333	-12	-254	- 25	-0.4224	20.5
Aug. 1	11.613	7.574	11.586	16.126	12	-225	- 64	.4197	20.6
2	11.523	7.567	11.833	15.913	12	-159	- 93	.4169	20.7
3	11.424	7.576	12.076	15.696	12	- 66	-106	.4142	20.7
4	11.321	7.606	12.316	15.474	11	+ 36	- 98	.4115	20.8
5	-11.224	-7.657	+12.553	-15.247	-11	+126	- 69	-0.4087	20.9
6	11.141	7.725	12.787	15.015	11	+182	- 23	.4060	20.9
7	11.079	7.801	13.016	14.779	11	+187	+ 30	.4032	21.0
8	11.039	7.871	13.242	14.538	11	+137	+ 78	.4005	21.1
9	11.016	7.922	13.463	14.293	11	+ 47	+106	.3978	21.1
10	-10.999	-7.947	+13.680	-14.043	-11	- 60	+109	-0.3950	21.2
11	10.978	7.945	13.893	13.790	12	-152	+ 85	.3923	21.3
12	10.941	7.923	14.102	13.533	12	-205	+ 41	.3896	21.3
13	10.884	7.893	14.307	13.272	12	-203	- 12	.3868	21.4
14	10.805	7.867	14.507	13.008	12	-146	- 60	.3841	21.4
15	-10.710	-7.856	+14.704	-12.741	-11	- 50	- 93	-0.3813	21.5
16	-10.609	-7.867	+14.896	-12.470	-11	+ 64	-104	-0.3786	21.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ⁸ .0001)	(0 ⁷ .001)	^{h m}
July 1	-2.1098	15.514	13 50 25	20.444	11 28 48	+1.203	- 82	94	15 43
2	.1028	15.463	13 50 26	20.437	11 25 17	1.337	-127	94	13 55
3	.0936	15.396	13 50 28	20.430	11 21 46	1.471	-149	97	12 12
4	.0821	15.315	13 50 34	20.421	11 18 14	1.605	-148	103	10 34
5	.0680	15.223	13 50 52	20.411	11 14 42	1.738	-122	109	9 06
6	-2.0519	15.124	13 51 27	20.401	11 11 09	+1.871	- 74	110	7 44
7	.0346	15.027	13 52 20	20.388	11 07 37	2.003	- 14	106	6 20
8	.0173	14.942	13 53 33	20.375	11 04 04	2.135	+ 46	95	4 46
9	2.0013	14.874	13 54 59	20.361	11 00 31	2.266	+ 94	82	2 49
10	1.9879	14.828	13 56 29	20.345	10 56 57	2.397	+116	75	0 18
11	-1.9777	14.802	13 57 53	20.328	10 53 24	+2.526	+106	82	21 47
12	.9705	14.789	13 59 00	20.310	10 49 50	2.655	+ 67	96	19 47
13	.9655	14.779	13 59 45	20.291	10 46 16	2.783	+ 7	107	18 09
14	.9610	14.759	14 00 08	20.272	10 42 41	2.910	- 58	110	16 40
15	.9553	14.721	14 00 15	20.251	10 39 07	3.035	-111	103	15 03
16	-1.9470	14.661	14 00 18	20.230	10 35 32	+3.160	-136	93	13 13
17	.9352	14.577	14 00 26	20.209	10 31 58	3.284	-127	86	10 55
18	.9203	14.479	14 00 49	20.187	10 28 22	3.408	- 86	89	8 34
19	.9032	14.376	14 01 34	20.165	10 24 47	3.529	- 21	100	6 31
20	.8852	14.282	14 02 41	20.142	10 21 11	3.650	+ 53	110	4 48
21	-1.8681	14.206	14 04 08	20.120	10 17 35	+3.770	+117	115	3 14
22	.8533	14.152	14 05 41	20.097	10 13 58	3.890	+161	116	1 44
23	.8414	14.121	14 07 16	20.074	10 10 21	4.008	+176	114	0 10
24	.8326	14.106	14 08 38	20.051	10 06 43	4.125	+160	111	22 38
25	.8265	14.102	14 09 44	20.027	10 03 05	4.241	+118	107	21 04
26	-1.8221	14.100	14 10 34	20.004	9 59 25	+4.356	+ 60	103	19 29
27	.8185	14.094	14 11 06	19.980	9 55 45	4.470	- 6	99	17 52
28	.8146	14.076	14 11 26	19.956	9 52 04	4.584	- 67	96	16 11
29	.8097	14.045	14 11 36	19.932	9 48 23	4.695	-117	95	14 25
30	.8028	13.998	14 11 46	19.907	9 44 41	4.806	-148	98	12 42
31	-1.7937	13.937	14 12 01	19.881	9 40 57	+4.916	-155	104	11 04
Aug. 1	.7822	13.865	14 12 27	19.857	9 37 13	5.024	-138	110	9 38
2	.7685	13.786	14 13 10	19.830	9 33 28	5.131	- 97	113	8 17
3	.7532	13.708	14 14 12	19.804	9 29 42	5.237	- 40	109	6 56
4	.7375	13.639	14 15 35	19.777	9 25 56	5.341	+ 22	99	5 27
5	-1.7226	13.587	14 17 12	19.750	9 22 08	+5.443	+ 77	85	3 36
6	.7098	13.557	14 18 57	19.722	9 18 20	5.545	+111	76	1 11
7	.7002	13.550	14 20 36	19.693	9 14 31	5.644	+114	80	22 32
8	.6941	13.558	14 21 57	19.665	9 10 41	5.742	+ 84	95	20 20
9	.6906	13.569	14 22 53	19.635	9 06 51	5.838	+ 29	108	18 40
10	-1.6881	13.570	14 23 24	19.605	9 03 00	+5.932	- 37	112	17 11
11	.6848	13.551	14 23 34	19.575	8 59 09	6.025	- 93	104	15 38
12	.6792	13.509	14 23 38	19.545	8 55 17	6.115	-125	91	13 47
13	.6704	13.445	14 23 48	19.515	8 51 24	6.204	-124	82	11 26
14	.6582	13.366	14 24 14	19.485	8 47 31	6.291	- 89	83	8 56
15	-1.6437	13.282	14 25 02	19.456	8 43 38	+6.376	- 31	95	6 48
16	-1.6282	13.208	14 26 14	19.427	8 39 44	+6.459	+ 39	107	5 05

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	d ψ	d ϵ	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^h
Aug. 16	-10.609	-7.867	+14.896	-12.470	-11	+ 64	-104	-0.3786	21.6
17	10.511	7.899	15.084	12.196	11	+172	- 93	.3759	21.6
18	10.426	7.952	15.268	11.919	11	+250	- 62	.3731	21.7
19	10.358	8.016	15.448	11.639	11	+285	- 19	.3704	21.8
20	10.310	8.083	15.624	11.356	11	+273	+ 27	.3677	21.8
21	-10.279	-8.142	+15.796	-11.070	-11	+217	+ 65	-0.3649	21.9
22	10.262	8.189	15.964	10.780	11	+128	+ 91	.3622	22.0
23	10.252	8.218	16.128	10.488	11	+ 23	+100	.3594	22.0
24	10.243	8.230	16.288	10.192	12	- 82	+ 92	.3567	22.1
25	10.228	8.225	16.443	9.894	12	-172	+ 67	.3540	22.2
26	-10.202	-8.208	+16.595	- 9.592	-12	-234	+ 31	-0.3512	22.2
27	10.162	8.185	16.742	9.287	12	-259	- 11	.3485	22.3
28	10.106	8.163	16.884	8.979	12	-245	- 52	.3458	22.4
29	10.037	8.148	17.022	8.668	12	-193	- 85	.3430	22.4
30	9.956	8.147	17.155	8.354	12	-112	-104	.3403	22.5
31	- 9.869	-8.165	+17.283	- 8.038	-12	- 15	-104	-0.3375	22.6
Sept. 1	9.783	8.203	17.407	7.718	11	+ 80	- 83	.3348	22.6
2	9.708	8.259	17.525	7.396	11	+151	- 43	.3321	22.7
3	9.649	8.329	17.638	7.071	11	+179	+ 10	.3293	22.8
4	9.614	8.396	17.746	6.743	11	+151	+ 62	.3266	22.8
5	- 9.597	-8.450	+17.848	- 6.414	-12	+ 75	+101	-0.3238	22.9
6	9.593	8.478	17.945	6.082	12	- 29	+114	.3211	23.0
7	9.587	8.476	18.037	5.748	12	-130	+ 98	.3184	23.0
8	9.568	8.449	18.123	5.413	12	-195	+ 57	.3156	23.1
9	9.526	8.408	18.203	5.076	12	-205	+ 3	.3129	23.2
10	- 9.462	-8.368	+18.278	- 4.738	-12	-156	- 50	-0.3102	23.2
11	9.380	8.342	18.347	4.398	12	- 63	- 88	.3074	23.3
12	9.290	8.337	18.411	4.058	12	+ 53	-104	.3047	23.4
13	9.202	8.355	18.470	3.717	12	+163	- 97	.3019	23.4
14	9.123	8.392	18.524	3.375	12	+249	- 70	.2992	23.5
15	- 9.062	-8.442	+18.572	- 3.032	-12	+293	- 30	-0.2965	23.6
16	9.019	8.497	18.616	2.688	12	+291	+ 16	.2937	23.6
17	8.995	8.547	18.654	2.344	12	+244	+ 57	.2910	23.7
18	8.984	8.585	18.687	1.999	12	+162	+ 87	.2883	23.7
19	8.982	8.606	18.716	1.654	12	+ 59	+101	.2855	23.8
20	- 8.981	-8.609	+18.739	- 1.307	-12	- 48	+ 97	-0.2828	23.9
21	8.976	8.594	18.757	0.960	13	-144	+ 76	.2800	23.9
22	8.961	8.566	18.770	0.613	13	-215	+ 43	.2773	0.0
23	8.933	8.530	18.778	- 0.265	13	-253	+ 2	.2746	0.1
24	8.890	8.493	18.780	+ 0.084	13	-252	- 39	.2718	0.1
25	- 8.831	-8.460	+18.778	+ 0.433	-13	-214	- 75	-0.2691	0.2
26	8.761	8.439	18.770	0.783	13	-145	- 99	.2664	0.3
27	8.683	8.435	18.756	1.133	13	- 57	-105	.2636	0.3
28	8.603	8.449	18.737	1.483	13	+ 35	- 93	.2609	0.4
29	8.529	8.483	18.712	1.834	12	+112	- 60	.2581	0.5
30	- 8.468	-8.530	+18.682	+ 2.184	-12	+156	- 13	-0.2554	0.5
Oct. 1	- 8.427	-8.582	+18.646	+ 2.534	-13	+149	+ 40	-0.2527	0.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^h .0001)	(0 ^h .001)	^{h m}
Aug. 16	-1.6282	13.208	14 26 14	19.427	8 39 44	+6.459	+ 39	107	5 05
17	.6132	13.148	14 27 42	19.398	8 35 50	6.541	+105	115	3 35
18	.6001	13.112	14 29 20	19.369	8 31 55	6.621	+153	117	2 08
19	.5897	13.097	14 30 57	19.342	8 27 59	6.699	+174	115	0 38
20	.5823	13.101	14 32 23	19.315	8 24 02	6.775	+167	112	23 04
21	-1.5776	13.113	14 33 32	19.289	8 20 06	+6.850	+133	108	21 32
22	.5750	13.129	14 34 21	19.263	8 16 07	6.923	+ 78	104	19 57
23	.5735	13.139	14 34 52	19.238	8 12 09	6.994	+ 14	100	18 21
24	.5720	13.140	14 35 07	19.214	8 08 08	7.063	- 50	98	16 42
25	.5697	13.125	14 35 13	19.190	8 04 09	7.130	-105	96	14 58
26	-1.5658	13.094	14 35 16	19.168	8 00 07	+7.196	-143	98	13 14
27	.5596	13.048	14 35 24	19.145	7 56 04	7.260	-158	104	11 36
28	.5512	12.991	14 35 43	19.123	7 52 01	7.322	-150	110	10 08
29	.5405	12.928	14 36 17	19.102	7 47 57	7.381	-118	114	8 48
30	.5280	12.865	14 37 11	19.081	7 43 51	7.439	- 69	113	7 33
31	-1.5147	12.809	14 38 25	19.061	7 39 46	+7.495	- 9	104	6 13
Sept. 1	.5016	12.767	14 39 55	19.041	7 35 39	7.548	+ 49	89	4 36
2	.4899	12.746	14 41 33	19.022	7 31 31	7.600	+ 92	74	2 23
3	.4810	12.747	14 43 12	19.003	7 27 23	7.649	+109	72	23 28
4	.4756	12.764	14 44 31	18.984	7 23 13	7.695	+ 92	86	20 56
5	-1.4731	12.787	14 45 27	18.965	7 19 04	+7.740	+ 46	105	19 06
6	.4724	12.802	14 45 52	18.948	7 14 53	7.782	- 18	115	17 37
7	.4715	12.797	14 45 55	18.931	7 10 42	7.822	- 80	111	16 09
8	.4686	12.764	14 45 47	18.914	7 06 31	7.859	-119	96	14 25
9	.4622	12.706	14 45 44	18.898	7 02 20	7.894	-125	82	12 08
10	-1.4523	12.631	14 45 57	18.882	6 58 08	+7.926	- 95	80	9 24
11	.4398	12.553	14 46 35	18.867	6 53 55	7.956	- 39	91	7 03
12	.4259	12.482	14 47 37	18.853	6 49 43	7.984	+ 32	106	5 14
13	.4124	12.429	14 48 57	18.840	6 45 31	8.009	+100	117	3 45
14	.4004	12.396	14 50 26	18.829	6 41 18	8.033	+152	121	2 21
15	-1.3910	12.385	14 51 53	18.818	6 37 05	+8.054	+179	120	0 58
16	.3844	12.391	14 53 10	18.809	6 32 52	8.073	+178	117	23 29
17	.3806	12.408	14 54 09	18.801	6 28 39	8.089	+149	113	21 58
18	.3790	12.426	14 54 48	18.794	6 24 25	8.103	+ 99	108	20 26
19	.3787	12.439	14 55 06	18.789	6 20 12	8.116	+ 36	104	18 52
20	-1.3786	12.441	14 55 09	18.784	6 15 57	+8.126	- 29	99	17 16
21	.3779	12.427	14 55 01	18.781	6 11 43	8.134	- 88	95	15 32
22	.3756	12.397	14 54 50	18.780	6 07 29	8.139	-132	96	13 47
23	.3713	12.351	14 54 43	18.780	6 03 14	8.143	-155	101	12 05
24	.3647	12.295	14 54 46	18.780	5 58 59	8.144	-154	108	10 35
25	-1.3557	12.229	14 55 05	18.783	5 54 43	+8.143	-131	114	9 14
26	.3449	12.164	14 55 43	18.786	5 50 27	8.139	- 89	115	8 01
27	.3329	12.106	14 56 41	18.790	5 46 10	8.133	- 35	107	6 49
28	.3207	12.058	14 57 56	18.796	5 41 54	8.125	+ 21	94	5 26
29	.3093	12.029	14 59 23	18.802	5 37 37	8.114	+ 69	75	3 34
30	-1.3000	12.019	15 00 50	18.809	5 33 20	+8.101	+ 95	63	0 47
Oct. 1	-1.2937	12.028	15 02 05	18.818	5 29 03	+8.086	+ 91	71	21 44

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 ^s .001)			^h
Oct. 1	- 8.427	-8.582	+18.646	+ 2.534	-13	+149	+ 40	-0.2527	0.6
2	8.406	8.628	18.604	2.884	13	+ 92	+ 87	.2499	0.7
3	8.401	8.653	18.556	3.234	13	- 4	+113	.2472	0.7
4	8.399	8.646	18.501	3.583	13	-111	+109	.2444	0.8
5	8.388	8.611	18.441	3.931	13	-194	+ 77	.2417	0.9
6	- 8.355	-8.555	+18.376	+ 4.278	-13	-223	+ 24	-0.2390	0.9
7	8.297	8.493	18.304	4.623	13	-189	- 34	.2362	1.0
8	8.216	8.442	18.227	4.966	13	- 98	- 80	.2335	1.1
9	8.122	8.412	18.143	5.308	13	+ 24	-105	.2308	1.1
10	8.027	8.408	18.055	5.648	13	+147	-103	.2280	1.2
11	- 7.942	-8.425	+17.961	+ 5.986	-13	+246	- 80	-0.2253	1.3
12	7.873	8.458	17.862	6.322	13	+303	- 40	.2225	1.3
13	7.823	8.495	17.758	6.656	13	+312	+ 5	.2198	1.4
14	7.790	8.530	17.649	6.988	13	+275	+ 48	.2171	1.5
15	7.773	8.554	17.535	7.318	13	+200	+ 81	.2143	1.5
16	- 7.765	-8.563	+17.416	+ 7.646	-13	+100	+ 99	-0.2116	1.6
17	7.760	8.555	17.292	7.972	13	- 8	+100	.2089	1.7
18	7.750	8.529	17.163	8.296	13	-108	+ 84	.2061	1.7
19	7.733	8.487	17.029	8.617	14	-187	+ 53	.2034	1.8
20	7.702	8.437	16.890	8.936	14	-234	+ 14	.2006	1.9
21	- 7.656	-8.384	+16.747	+ 9.253	-14	-245	- 28	-0.1979	1.9
22	7.594	8.334	16.598	9.568	14	-217	- 66	.1952	2.0
23	7.520	8.295	16.444	9.880	14	-159	- 93	.1924	2.0
24	7.437	8.271	16.286	10.190	14	- 79	-104	.1897	2.1
25	7.350	8.265	16.122	10.498	13	+ 8	- 97	.1870	2.2
26	- 7.266	-8.277	+15.954	+10.802	-13	+ 85	- 72	-0.1842	2.2
27	7.193	8.306	15.780	11.104	13	+135	- 30	.1815	2.3
28	7.136	8.342	15.601	11.403	13	+143	+ 20	.1787	2.4
29	7.098	8.377	15.417	11.699	13	+102	+ 69	.1760	2.4
30	7.076	8.396	15.228	11.992	13	+ 19	+103	.1733	2.5
31	- 7.063	-8.392	+15.033	+12.281	-14	- 88	+113	-0.1705	2.6
Nov. 1	7.046	8.357	14.834	12.567	14	-187	+ 93	.1678	2.6
2	7.011	8.297	14.629	12.849	14	-243	+ 48	.1650	2.7
3	6.950	8.223	14.420	13.127	14	-234	- 11	.1623	2.8
4	6.863	8.154	14.205	13.400	14	-160	- 65	.1596	2.8
5	- 6.756	-8.102	+13.986	+13.670	-13	- 38	-101	-0.1568	2.9
6	6.641	8.079	13.763	13.935	13	+ 99	-109	.1541	3.0
7	6.533	8.080	13.535	14.195	13	+220	- 92	.1514	3.0
8	6.442	8.102	13.304	14.450	13	+298	- 55	.1486	3.1
9	6.369	8.133	13.068	14.701	13	+326	- 8	.1459	3.2
10	- 6.317	-8.162	+12.828	+14.947	-13	+302	+ 37	-0.1431	3.2
11	6.281	8.184	12.585	15.188	13	+236	+ 74	.1404	3.3
12	6.255	8.190	12.338	15.425	13	+141	+ 96	.1377	3.4
13	6.234	8.180	12.088	15.657	13	+ 34	+101	.1349	3.4
14	6.211	8.153	11.834	15.884	13	- 70	+ 89	.1322	3.5
15	- 6.180	-8.111	+11.577	+16.107	-13	-156	+ 63	-0.1295	3.6
16	- 6.136	-8.058	+11.316	+16.325	-13	-211	+ 25	-0.1267	3.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Oct. 1	-1.2937	12.028	15 02 05	18.818	5 29 03	+8.086	+ 91	71	21 44
2	.2905	12.046	15 02 59	18.826	5 24 45	8.067	+ 56	94	19 31
3	.2897	12.060	15 03 23	18.836	5 20 27	8.047	- 2	113	17 57
4	.2895	12.054	15 03 19	18.845	5 16 09	8.023	- 68	118	16 32
5	.2878	12.021	15 03 01	18.856	5 11 52	7.997	-119	109	15 00
6	-1.2827	11.958	15 02 43	18.867	5 07 35	+7.969	-136	92	13 01
7	.2738	11.873	15 02 41	18.879	5 03 18	7.937	-116	82	10 23
8	.2613	11.780	15 03 07	18.891	4 59 02	7.904	- 60	89	7 44
9	.2469	11.693	15 04 01	18.904	4 54 46	7.868	+ 15	105	5 39
10	.2324	11.624	15 05 19	18.918	4 50 31	7.829	+ 90	118	4 02
11	-1.2193	11.578	15 06 46	18.932	4 46 16	+7.789	+150	126	2 37
12	.2087	11.555	15 08 13	18.948	4 42 02	7.746	+185	127	1 13
13	.2010	11.548	15 09 26	18.964	4 37 49	7.701	+191	124	23 51
14	.1961	11.552	15 10 23	18.982	4 33 36	7.653	+168	120	22 25
15	.1933	11.558	15 10 57	19.001	4 29 24	7.604	+122	114	20 58
16	-1.1921	11.559	15 11 12	19.021	4 25 11	+7.552	+ 61	107	19 27
17	.1914	11.550	15 11 10	19.041	4 21 00	7.498	- 5	100	17 53
18	.1900	11.524	15 10 58	19.063	4 16 49	7.443	- 66	94	16 12
19	.1873	11.482	15 10 39	19.085	4 12 39	7.384	-114	91	14 22
20	.1826	11.424	15 10 26	19.108	4 08 28	7.324	-143	94	12 34
21	-1.1756	11.354	15 10 24	19.133	4 04 19	+7.262	-150	101	10 56
22	.1661	11.275	15 10 39	19.158	4 00 09	7.198	-133	109	9 30
23	.1547	11.196	15 11 14	19.184	3 56 00	7.131	- 97	113	8 17
24	.1419	11.123	15 12 10	19.211	3 51 52	7.062	- 48	109	7 07
25	.1285	11.060	15 13 25	19.239	3 47 43	6.991	+ 5	97	5 53
26	-1.1158	11.014	15 14 53	19.267	3 43 36	+6.918	+ 52	80	4 19
27	.1045	10.988	15 16 26	19.295	3 39 28	6.843	+ 83	62	1 57
28	.0957	10.978	15 17 49	19.324	3 35 21	6.765	+ 87	60	22 42
29	.0899	10.980	15 18 54	19.353	3 31 14	6.685	+ 62	80	20 02
30	.0865	10.980	15 19 30	19.383	3 27 07	6.603	+ 12	103	18 17
31	-1.0846	10.969	15 19 40	19.412	3 23 01	+6.519	- 54	118	16 51
Nov. 1	.0820	10.931	15 19 28	19.442	3 18 55	6.433	-114	119	15 26
2	.0767	10.863	15 19 13	19.470	3 14 50	6.344	-149	108	13 46
3	.0673	10.767	15 19 11	19.500	3 10 45	6.253	-143	94	11 33
4	.0538	10.658	15 19 39	19.528	3 06 41	6.160	- 98	91	8 58
5	-1.0374	10.549	15 20 42	19.557	3 02 37	+6.065	- 23	102	6 34
6	.0199	10.458	15 22 19	19.586	2 58 35	5.968	+ 61	116	4 41
7	1.0033	10.391	15 24 10	19.614	2 54 33	5.869	+135	127	3 06
8	0.9892	10.351	15 26 03	19.642	2 50 32	5.769	+182	131	1 40
9	.9781	10.330	15 27 44	19.669	2 46 32	5.667	+199	130	0 14
10	-0.9701	10.321	15 29 03	19.697	2 42 33	+5.563	+185	126	22 52
11	.9645	10.316	15 29 59	19.725	2 38 35	5.457	+144	119	21 27
12	.9606	10.305	15 30 31	19.752	2 34 37	5.350	+ 86	111	20 01
13	.9574	10.285	15 30 46	19.780	2 30 41	5.242	+ 21	102	18 30
14	.9538	10.249	15 30 48	19.808	2 26 45	5.132	- 43	93	16 51
15	-0.9492	10.197	15 30 47	19.836	2 22 50	+5.020	- 95	88	15 02
16	-0.9424	10.128	15 30 51	19.863	2 18 55	+4.907	-129	88	13 06

FOR 0^h EPHEMERIS TIME

Date	A	B	C	D	E	dψ	dε	τ	S.T.
					(0 ^s .0001)	(0 [″] .001)			^h
Nov. 16	- 6.136	-8.058	+11.316	+16.325	-13	-211	+ 25	-0.1267	3.6
17	6.078	8.001	11.052	16.538	13	-231	- 17	.1240	3.7
18	6.003	7.948	10.784	16.747	13	-212	- 56	.1212	3.8
19	5.915	7.902	10.514	16.950	13	-160	- 87	.1185	3.8
20	5.817	7.873	10.239	17.149	13	- 84	-102	.1158	3.9
21	- 5.715	-7.861	+ 9.962	+17.343	-13	0	-100	-0.1130	4.0
22	5.614	7.868	9.681	17.532	13	+ 78	- 79	.1103	4.0
23	5.523	7.892	9.397	17.717	13	+131	- 42	.1076	4.1
24	5.446	7.926	9.110	17.896	12	+147	+ 5	.1048	4.2
25	5.387	7.961	8.820	18.070	12	+117	+ 53	.1021	4.2
26	- 5.345	-7.987	+ 8.526	+18.238	-12	+ 44	+ 91	-0.0993	4.3
27	5.313	7.994	8.229	18.401	13	- 57	+110	.0966	4.3
28	5.282	7.973	7.929	18.558	13	-163	+101	.0939	4.4
29	5.241	7.928	7.626	18.710	13	-243	+ 67	.0911	4.5
30	5.177	7.864	7.320	18.856	13	-266	+ 13	.0884	4.5
Dec. 1	- 5.085	-7.797	+ 7.012	+18.995	-13	-222	- 44	-0.0856	4.6
2	4.969	7.742	6.701	19.128	12	-117	- 89	.0829	4.7
3	4.838	7.711	6.388	19.254	12	+ 22	-111	.0802	4.7
4	4.708	7.710	6.072	19.374	12	+160	-103	.0774	4.8
5	4.591	7.733	5.755	19.488	12	+265	- 72	.0747	4.9
6	- 4.493	-7.771	+ 5.436	+19.595	-11	+318	- 26	-0.0720	4.9
7	4.418	7.812	5.116	19.695	11	+316	+ 22	.0692	5.0
8	4.361	7.848	4.794	19.790	11	+264	+ 64	.0665	5.1
9	4.319	7.869	4.471	19.877	11	+177	+ 91	.0637	5.1
10	4.283	7.875	4.146	19.959	11	+ 72	+102	.0610	5.2
11	- 4.247	-7.862	+ 3.821	+20.034	-11	- 34	+ 94	-0.0583	5.3
12	4.205	7.835	3.495	20.103	12	-125	+ 71	.0555	5.3
13	4.153	7.797	3.167	20.166	12	-190	+ 36	.0528	5.4
14	4.086	7.753	2.839	20.223	11	-219	- 5	.0501	5.5
15	4.003	7.710	2.511	20.273	11	-209	- 46	.0473	5.5
16	- 3.906	-7.675	+ 2.181	+20.318	-11	-164	- 80	-0.0446	5.6
17	3.799	7.655	1.851	20.357	11	- 92	- 99	.0418	5.7
18	3.685	7.652	1.520	20.389	11	- 5	-102	.0391	5.7
19	3.572	7.670	1.189	20.416	11	+ 78	- 85	.0364	5.8
20	3.469	7.705	0.857	20.437	10	+138	- 51	.0336	5.9
21	- 3.380	-7.753	+ 0.525	+20.451	-10	+162	- 6	-0.0309	5.9
22	3.309	7.803	+ 0.192	20.460	10	+142	+ 42	.0282	6.0
23	3.254	7.847	- 0.141	20.462	10	+ 78	+ 82	.0254	6.1
24	3.213	7.874	0.475	20.458	10	- 19	+105	.0227	6.1
25	3.177	7.878	0.808	20.447	10	-126	+104	.0199	6.2
26	- 3.134	-7.859	- 1.142	+20.430	-10	-218	+ 79	-0.0172	6.3
27	3.073	7.818	1.476	20.406	10	-266	+ 32	.0145	6.3
28	2.989	7.770	1.810	20.375	10	-254	- 23	.0117	6.4
29	2.880	7.726	2.144	20.338	10	-177	- 74	.0090	6.5
30	2.751	7.704	2.478	20.294	10	- 54	-105	.0063	6.5
31	- 2.617	-7.708	- 2.810	+20.243	- 9	+ 85	-110	-0.0035	6.6
32	- 2.489	-7.739	- 3.141	+20.185	- 9	+209	- 88	-0.0008	6.6

FOR 0^h EPHEMERIS TIME

Date	<i>f</i>	<i>g</i>	<i>G</i>	<i>h</i>	<i>H</i>	<i>i</i>	<i>f'</i>	<i>g'</i>	<i>G'</i>
	^s	["]	^{h m s}	["]	^{h m s}	["]	(0 ^s .0001)	(0 ["] .001)	^{h m}
Nov. 16	-0.9424	10.128	15 30 51	19.863	2 18 55	+4.907	-129	88	13 06
17	.9335	10.048	15 31 07	19.891	2 15 01	4.793	-141	93	11 18
18	.9220	9.960	15 31 45	19.919	2 11 07	4.676	-130	101	9 46
19	.9085	9.871	15 32 44	19.946	2 07 15	4.559	- 98	108	8 25
20	.8934	9.789	15 34 10	19.973	2 03 22	4.440	- 51	107	7 13
21	-0.8777	9.719	15 35 56	20.001	1 59 30	+4.320	0	100	6 00
22	.8623	9.666	15 37 58	20.027	1 55 38	4.198	+ 48	85	4 34
23	.8483	9.633	15 40 04	20.055	1 51 46	4.075	+ 80	67	2 35
24	.8365	9.617	15 42 02	20.081	1 47 55	3.950	+ 90	59	23 40
25	.8275	9.612	15 43 40	20.108	1 44 04	3.825	+ 72	70	20 45
26	-0.8209	9.610	15 44 50	20.133	1 40 13	+3.697	+ 27	93	18 44
27	.8161	9.599	15 45 34	20.157	1 36 23	3.568	- 35	112	17 14
28	.8114	9.564	15 45 54	20.181	1 32 32	3.438	-100	120	15 49
29	.8051	9.504	15 46 08	20.205	1 28 42	3.307	-149	118	14 19
30	.7952	9.415	15 46 34	20.227	1 24 52	3.174	-163	107	12 28
Dec. 1	-0.7811	9.309	15 47 33	20.248	1 21 03	+3.041	-136	99	10 14
2	.7632	9.199	15 49 14	20.268	1 17 14	2.906	- 72	100	7 50
3	.7433	9.103	15 51 35	20.286	1 13 25	2.770	+ 13	111	5 42
4	.7232	9.034	15 54 22	20.303	1 09 36	2.633	+ 98	121	3 53
5	.7052	8.993	15 57 13	20.320	1 05 48	2.496	+162	128	2 17
6	-0.6902	8.976	15 59 51	20.335	1 02 01	+2.357	+194	129	0 46
7	.6786	8.975	16 02 03	20.348	0 58 15	2.218	+193	128	23 20
8	.6700	8.978	16 03 46	20.362	0 54 28	2.079	+161	123	21 55
9	.6635	8.976	16 04 58	20.374	0 50 42	1.939	+108	115	20 31
10	.6580	8.964	16 05 50	20.385	0 46 57	1.798	+ 44	106	19 03
11	-0.6525	8.936	16 06 29	20.395	0 43 12	+1.657	- 21	95	17 27
12	.6461	8.892	16 07 07	20.405	0 39 27	1.516	- 76	87	15 40
13	.6381	8.834	16 07 50	20.413	0 35 42	1.373	-116	84	13 42
14	.6277	8.764	16 08 50	20.421	0 31 58	1.231	-134	87	11 47
15	.6151	8.687	16 10 15	20.428	0 28 15	1.089	-128	95	10 04
16	-0.6002	8.612	16 12 07	20.435	0 24 30	+0.946	-100	103	8 37
17	.5837	8.546	16 14 26	20.441	0 20 47	0.803	- 56	106	7 21
18	.5662	8.493	16 17 09	20.446	0 17 03	0.659	- 3	102	6 04
19	.5489	8.461	16 20 07	20.451	0 13 20	0.516	+ 48	90	4 40
20	.5330	8.450	16 23 03	20.455	0 09 36	0.372	+ 84	75	2 52
21	-0.5194	8.458	16 25 47	20.458	0 05 53	+0.228	+ 99	65	0 21
22	.5084	8.476	16 28 05	20.461	0 02 09	+0.083	+ 87	70	21 33
23	.5001	8.495	16 29 55	20.463	23 58 25	-0.061	+ 48	88	19 23
24	.4938	8.504	16 31 13	20.464	23 54 41	0.206	- 12	105	17 44
25	.4882	8.495	16 32 09	20.463	23 50 57	0.350	- 77	115	16 17
26	-0.4816	8.461	16 33 02	20.462	23 47 12	-0.495	-133	117	14 49
27	.4724	8.400	16 34 10	20.459	23 43 27	0.640	-163	110	13 07
28	.4595	8.325	16 35 50	20.455	23 39 42	0.785	-155	104	11 09
29	.4426	8.245	16 38 14	20.451	23 35 56	0.930	-108	102	8 54
30	.4230	8.180	16 41 24	20.445	23 32 09	1.075	- 33	107	6 46
31	-0.4023	8.140	16 44 59	20.437	23 28 23	-1.219	+ 52	115	4 52
32	-0.3827	8.129	16 48 41	20.428	23 24 37	-1.362	+128	121	3 07

Date	A	B	C	D	Date	A	B	C	D
Jan. 0	- 4.397	-6.212	- 3.123	+20.172	Feb. 15	- 1.503	-7.203	-15.613	+11.370
1	4.346	6.266	3.451	20.110	16	1.465	7.186	15.793	11.068
2	4.309	6.298	3.777	20.042	17	1.412	7.166	15.968	10.763
3	4.273	6.307	4.103	19.968	18	1.343	7.151	16.138	10.455
4	4.229	6.293	4.428	19.887	19	1.260	7.148	16.302	10.144
5	- 4.169	-6.262	- 4.752	+19.799	20	- 1.167	-7.163	-16.461	+ 9.831
6	4.088	6.228	5.075	19.705	21	1.072	7.201	16.615	9.515
7	3.989	6.201	5.396	19.605	22	0.987	7.262	16.764	9.197
8	3.876	6.191	5.716	19.498	23	0.920	7.336	16.908	8.876
9	3.760	6.202	6.034	19.384	24	0.877	7.411	17.048	8.553
10	- 3.648	-6.235	- 6.350	+19.264	25	- 0.856	-7.472	-17.182	+ 8.228
11	3.549	6.284	6.664	19.137	26	0.849	7.508	17.312	7.901
12	3.465	6.343	6.976	19.004	27	0.842	7.514	17.436	7.572
13	3.401	6.404	7.285	18.865	28	0.822	7.494	17.556	7.240
14	3.352	6.460	7.592	18.720	Mar. 1	0.782	7.461	17.671	6.906
15	- 3.314	-6.504	- 7.895	+18.569	2	- 0.722	-7.427	-17.780	+ 6.569
16	3.284	6.534	8.196	18.411	3	0.645	7.405	17.885	6.231
17	3.254	6.547	8.494	18.249	4	0.559	7.401	17.984	5.890
18	3.219	6.545	8.788	18.080	5	0.474	7.419	18.077	5.548
19	3.172	6.532	9.080	17.906	6	0.397	7.454	18.164	5.203
20	- 3.112	-6.511	- 9.369	+17.727	7	- 0.333	-7.501	-18.246	+ 4.857
21	3.033	6.492	9.654	17.543	8	0.286	7.556	18.322	4.508
22	2.938	6.482	9.936	17.353	9	0.256	7.610	18.392	4.159
23	2.830	6.488	10.215	17.159	10	0.240	7.656	18.456	3.808
24	2.717	6.516	10.491	16.959	11	0.235	7.687	18.514	3.456
25	- 2.609	-6.568	-10.763	+16.755	12	- 0.235	-7.702	-18.566	+ 3.104
26	2.516	6.639	11.033	16.546	13	0.232	7.700	18.613	2.750
27	2.444	6.719	11.298	16.332	14	0.222	7.682	18.653	2.396
28	2.398	6.793	11.561	16.114	15	0.200	7.654	18.688	2.042
29	2.369	6.847	11.820	15.890	16	0.163	7.620	18.716	1.688
30	- 2.347	-6.874	-12.076	+15.661	17	- 0.110	-7.588	-18.739	+ 1.333
31	2.321	6.876	12.329	15.428	18	- 0.043	7.565	18.756	0.979
Feb. 1	2.279	6.860	12.578	15.189	19	+ 0.035	7.557	18.767	0.625
2	2.218	6.835	12.823	14.946	20	0.119	7.569	18.773	+ 0.271
3	2.139	6.813	13.065	14.698	21	0.199	7.601	18.773	- 0.082
4	- 2.045	-6.805	-13.303	+14.445	22	+ 0.267	-7.653	-18.768	- 0.434
5	1.946	6.817	13.536	14.187	23	0.315	7.713	18.758	0.786
6	1.849	6.849	13.766	13.925	24	0.340	7.766	18.742	1.137
7	1.762	6.899	13.991	13.658	25	0.348	7.800	18.721	1.488
8	1.689	6.962	14.211	13.386	26	0.348	7.804	18.695	1.838
9	- 1.633	-7.028	-14.426	+13.110	27	+ 0.356	-7.778	-18.664	- 2.187
10	1.596	7.091	14.636	12.829	28	0.383	7.731	18.628	2.535
11	1.571	7.144	14.841	12.545	29	0.433	7.676	18.586	2.883
12	1.556	7.182	15.042	12.256	30	0.505	7.628	18.539	3.230
13	1.543	7.204	15.237	11.964	31	0.591	7.598	18.487	3.577
14	- 1.527	-7.210	-15.427	+11.669	Apr. 1	+ 0.679	-7.592	-18.430	- 3.922
15	- 1.503	-7.203	-15.613	+11.370	2	+ 0.761	-7.604	-18.367	- 4.267

E can be taken from pages 258-272 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Apr. 1	+ 0.679	-7.592	-18.430	- 3.922	May 17	+ 3.154	-7.248	-10.559	-16.933
2	0.761	7.604	18.367	4.267	18	3.198	7.281	10.297	17.122
3	0.831	7.632	18.299	4.611	19	3.227	7.297	10.032	17.306
4	0.884	7.670	18.225	4.953	20	3.252	7.287	9.765	17.485
5	0.919	7.707	18.145	5.294	21	3.283	7.249	9.496	17.659
6	+ 0.940	-7.737	-18.060	- 5.634	22	+ 3.334	-7.190	- 9.225	-17.828
7	0.949	7.757	17.969	5.972	23	3.410	7.124	8.951	17.992
8	0.954	7.761	17.873	6.308	24	3.510	7.066	8.675	18.152
9	0.958	7.748	17.771	6.642	25	3.626	7.027	8.397	18.307
10	0.968	7.718	17.664	6.973	26	3.746	7.013	8.116	18.458
11	+ 0.989	-7.676	-17.551	- 7.302	27	+ 3.858	-7.024	- 7.834	-18.603
12	1.025	7.626	17.433	7.629	28	3.955	7.052	7.549	18.744
13	1.077	7.576	17.310	7.953	29	4.033	7.088	7.262	18.880
14	1.144	7.533	17.182	8.274	30	4.093	7.123	6.973	19.011
15	1.224	7.505	17.049	8.592	31	4.137	7.150	6.681	19.137
16	+ 1.311	-7.493	-16.911	- 8.907	June 1	+ 4.171	-7.164	- 6.388	-19.257
17	1.397	7.502	16.768	9.219	2	4.201	7.162	6.092	19.372
18	1.475	7.530	16.621	9.528	3	4.232	7.144	5.795	19.482
19	1.537	7.570	16.469	9.834	4	4.272	7.112	5.496	19.586
20	1.579	7.612	16.313	10.136	5	4.324	7.069	5.195	19.685
21	+ 1.602	-7.643	-16.152	-10.435	6	+ 4.391	-7.022	- 4.892	-19.778
22	1.613	7.649	15.987	10.730	7	4.475	6.978	4.588	19.865
23	1.625	7.624	15.818	11.023	8	4.574	6.944	4.283	19.946
24	1.651	7.573	15.645	11.312	9	4.684	6.927	3.977	20.021
25	1.700	7.507	15.468	11.598	10	4.797	6.931	3.669	20.090
26	+ 1.774	-7.440	-15.287	-11.881	11	+ 4.906	-6.956	- 3.361	-20.153
27	1.868	7.387	15.102	12.161	12	5.001	6.996	3.052	20.210
28	1.972	7.359	14.913	12.438	13	5.078	7.045	2.742	20.261
29	2.073	7.354	14.719	12.711	14	5.136	7.092	2.432	20.306
30	2.163	7.368	14.521	12.981	15	5.178	7.125	2.122	20.346
May 1	+ 2.236	-7.394	-14.319	-13.248	16	+ 5.212	-7.136	- 1.811	-20.380
2	2.291	7.423	14.113	13.511	17	5.247	7.122	1.501	20.408
3	2.329	7.449	13.902	13.770	18	5.297	7.084	1.190	20.431
4	2.356	7.465	13.688	14.025	19	5.368	7.035	0.880	20.448
5	2.374	7.467	13.469	14.276	20	5.463	6.986	0.569	20.461
6	+ 2.391	-7.452	-13.247	-14.524	21	+ 5.577	-6.951	- 0.259	-20.467
7	2.412	7.420	13.020	14.766	22	5.702	6.941	+ 0.051	20.469
8	2.443	7.376	12.790	15.005	23	5.825	6.955	0.361	20.465
9	2.488	7.322	12.556	15.239	24	5.936	6.989	0.671	20.456
10	2.549	7.267	12.318	15.468	25	6.029	7.039	0.981	20.443
11	+ 2.626	-7.216	-12.076	-15.692	26	+ 6.102	-7.091	+ 1.291	-20.424
12	2.717	7.178	11.831	15.912	27	6.156	7.138	1.601	20.399
13	2.816	7.158	11.583	16.126	28	6.198	7.173	1.911	20.369
14	2.917	7.158	11.331	16.336	29	6.232	7.193	2.221	20.333
15	3.011	7.176	11.077	16.540	30	6.265	7.196	2.530	20.292
16	+ 3.091	-7.209	-10.819	-16.739	July 1	+ 6.302	-7.185	+ 2.840	-20.245
17	+ 3.154	-7.248	-10.559	-16.933	2	+ 6.351	-7.160	+ 3.148	-20.192

E can be taken from pages 258-272 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
July 1	-13.739	-7.185	+ 2.845	-20.243	Aug. 17	-10.502	-7.903	+15.102	-12.170
2	13.690	7.160	3.153	20.191	18	10.419	7.958	15.285	11.893
3	13.627	7.130	3.461	20.132	19	10.353	8.022	15.464	11.613
4	13.548	7.099	3.768	20.068	20	10.307	8.089	15.640	11.331
5	13.454	7.076	4.074	19.998	21	10.277	8.147	15.811	11.045
6	-13.347	-7.068	+ 4.380	-19.922	22	-10.261	-8.192	+15.978	-10.756
7	13.234	7.079	4.684	19.840	23	10.251	8.220	16.141	10.464
8	13.122	7.113	4.987	19.752	24	10.242	8.230	16.300	10.169
9	13.022	7.165	5.288	19.659	25	10.226	8.224	16.455	9.871
10	12.939	7.230	5.587	19.559	26	10.200	8.206	16.605	9.569
11	-12.876	-7.294	+ 5.885	-19.454	27	-10.159	-8.183	+16.751	- 9.265
12	12.833	7.347	6.180	19.343	28	10.102	8.162	16.893	8.958
13	12.802	7.379	6.474	19.227	29	10.032	8.147	17.030	8.648
14	12.772	7.386	6.765	19.105	30	9.951	8.148	17.163	8.334
15	12.732	7.371	7.054	18.979	31	9.864	8.167	17.290	8.018
16	-12.674	-7.341	+ 7.341	-18.847	Sept. 1	- 9.778	-8.206	+17.413	- 7.699
17	12.594	7.306	7.626	18.711	2	9.704	8.263	17.531	7.378
18	12.494	7.281	7.909	18.569	3	9.647	8.333	17.644	7.054
19	12.380	7.274	8.189	18.423	4	9.613	8.399	17.751	6.727
20	12.264	7.291	8.467	18.272	5	9.597	8.452	17.853	6.398
21	-12.155	-7.332	+ 8.743	-18.117	6	- 9.593	-8.478	+17.950	- 6.067
22	12.062	7.389	9.016	17.957	7	9.587	8.475	18.041	5.734
23	11.988	7.455	9.287	17.792	8	9.567	8.448	18.126	5.400
24	11.935	7.518	9.556	17.623	9	9.524	8.406	18.206	5.064
25	11.897	7.571	9.823	17.449	10	9.460	8.367	18.280	4.727
26	-11.869	-7.610	+10.087	-17.270	11	- 9.377	-8.342	+18.349	- 4.389
27	11.846	7.632	10.349	17.087	12	9.288	8.337	18.413	4.049
28	11.820	7.637	10.609	16.898	13	9.200	8.356	18.472	3.709
29	11.786	7.627	10.866	16.705	14	9.122	8.393	18.525	3.367
30	11.739	7.609	11.120	16.507	15	9.061	8.443	18.574	3.025
31	-11.678	-7.588	+11.372	-16.304	16	- 9.018	-8.498	+18.617	- 2.683
Aug. 1	11.601	7.572	11.621	16.096	17	8.995	8.548	18.655	2.339
2	11.510	7.567	11.867	15.883	18	8.984	8.585	18.688	1.995
3	11.410	7.579	12.109	15.666	19	8.982	8.606	18.716	1.650
4	11.308	7.612	12.348	15.444	20	8.981	8.609	18.739	1.305
5	-11.212	-7.665	+12.584	-15.216	21	- 8.976	-8.594	+18.757	- 0.959
6	11.132	7.735	12.816	14.985	21	8.961	8.566	18.770	0.613
7	11.073	7.810	13.044	14.749	22	8.933	8.530	18.778	- 0.266
8	11.036	7.878	13.269	14.508	23	8.890	8.493	18.780	+ 0.082
9	11.014	7.926	13.489	14.263	24	8.832	8.460	18.778	0.430
10	-10.997	-7.948	+13.705	-14.014	25	- 8.762	-8.439	+18.770	+ 0.779
11	10.975	7.943	13.917	13.760	26	8.684	8.435	18.756	1.128
12	10.936	7.920	14.125	13.504	27	8.604	8.449	18.737	1.477
13	10.876	7.890	14.329	13.243	28	8.530	8.482	18.713	1.827
14	10.795	7.865	14.528	12.980	29	8.469	8.529	18.682	2.176
15	-10.700	-7.856	+14.724	-12.713	30	- 8.428	-8.581	+18.647	+ 2.525
16	10.599	7.869	14.915	12.443	Oct. 1	8.406	8.627	18.605	2.874
17	-10.502	-7.903	+15.102	-12.170	2	- 8.401	-8.653	+18.557	+ 3.223

E can be taken from pages 258-272 without appreciable error.

FOR 0^h SIDEREAL TIME

Date	A	B	C	D	Date	A	B	C	D
Oct. 1	- 8.406	-8.627	+18.605	+ 2.874	Nov. 16	- 6.088	-8.010	+11.092	+16.505
2	8.401	8.653	18.557	3.223	17	6.016	7.956	10.826	16.714
3	8.399	8.647	18.503	3.571	18	5.930	7.909	10.557	16.918
4	8.389	8.613	18.443	3.918	19	5.833	7.877	10.284	17.117
5	8.357	8.557	18.378	4.264	20	5.732	7.862	10.008	17.311
6	- 8.300	-8.495	+18.307	+ 4.609	21	- 5.630	-7.866	+ 9.728	+17.501
7	8.220	8.444	18.230	4.951	22	5.538	7.887	9.446	17.685
8	8.127	8.413	18.148	5.292	23	5.458	7.920	9.160	17.865
9	8.032	8.408	18.060	5.631	24	5.396	7.955	8.870	18.039
10	7.946	8.424	17.966	5.969	25	5.351	7.983	8.578	18.208
11	- 7.876	-8.456	+17.868	+ 6.304	26	- 5.318	-7.994	+ 8.282	+18.372
12	7.825	8.493	17.765	6.637	27	5.288	7.979	7.984	18.530
13	7.792	8.528	17.656	6.969	28	5.250	7.938	7.682	18.682
14	7.774	8.553	17.543	7.298	29	5.191	7.877	7.378	18.829
15	7.765	8.563	17.424	7.625	30	5.105	7.810	7.071	18.969
16	- 7.760	-8.556	+17.301	+ 7.950	Dec. 1	- 4.993	-7.751	+ 6.761	+19.103
17	7.751	8.531	17.173	8.273	2	4.864	7.715	6.450	19.230
18	7.735	8.491	17.039	8.594	3	4.734	7.708	6.136	19.351
19	7.705	8.441	16.901	8.912	4	4.613	7.727	5.820	19.466
20	7.660	8.388	16.758	9.228	5	4.511	7.762	5.502	19.574
21	- 7.600	-8.338	+16.610	+ 9.542	6	- 4.432	-7.804	+ 5.183	+19.675
22	7.527	8.298	16.457	9.854	7	4.372	7.841	4.862	19.771
23	7.445	8.272	16.300	10.163	8	4.327	7.866	4.540	19.859
24	7.358	8.265	16.137	10.470	9	4.291	7.875	4.216	19.942
25	7.274	8.275	15.970	10.774	10	4.255	7.866	3.892	20.018
26	- 7.199	-8.303	+15.797	+11.075	11	- 4.215	-7.842	+ 3.567	+20.088
27	7.141	8.338	15.619	11.374	12	4.166	7.806	3.241	20.152
28	7.101	8.374	15.436	11.669	13	4.103	7.763	2.914	20.210
29	7.078	8.395	15.248	11.962	14	4.023	7.719	2.586	20.262
30	7.064	8.394	15.054	12.251	15	3.930	7.682	2.258	20.308
31	- 7.048	-8.362	+14.856	+12.536	16	- 3.825	-7.658	+ 1.929	+20.348
Nov. 1	7.016	8.305	14.652	12.818	17	3.712	7.651	1.599	20.382
2	6.958	8.232	14.444	13.095	18	3.599	7.664	1.269	20.410
3	6.874	8.162	14.231	13.369	19	3.493	7.695	0.938	20.432
4	6.770	8.107	14.013	13.638	20	3.400	7.741	0.607	20.448
5	- 6.655	-8.080	+13.791	+13.903	21	- 3.325	-7.791	+ 0.275	+20.458
6	6.546	8.079	13.565	14.163	22	3.266	7.837	- 0.057	20.462
7	6.453	8.098	13.334	14.418	23	3.223	7.869	0.389	20.459
8	6.378	8.129	13.100	14.668	24	3.186	7.879	0.722	20.450
9	6.323	8.158	12.861	14.914	25	3.146	7.866	1.055	20.435
10	- 6.285	-8.182	+12.619	+15.155	26	- 3.091	-7.830	- 1.388	+20.413
11	6.258	8.190	12.373	15.392	27	3.014	7.783	1.722	20.384
12	6.237	8.182	12.124	15.624	28	2.911	7.737	2.055	20.349
13	6.215	8.158	11.871	15.851	29	2.787	7.708	2.387	20.307
14	6.185	8.118	11.615	16.074	30	2.654	7.704	2.719	20.258
15	- 6.144	-8.066	+11.355	+16.292	31	- 2.523	-7.728	- 3.050	+20.202
16	- 6.088	-8.010	+11.092	+16.505	32	- 2.408	-7.776	- 3.380	+20.138

E can be taken from pages 258-272 without appreciable error.

FOR NORTHERN DECLINATIONS

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J (0 ^s .00001)														
Jan.	0	- 5	- 3	0	+ 3	+ 5	+ 5	+ 5	+ 3	0	- 3	- 5	- 5	- 5
	10	- 6	- 5	- 2	+ 1	+ 4	+ 6	+ 6	+ 5	+ 2	- 1	- 4	- 6	- 6
	20	- 8	- 7	- 4	0	+ 3	+ 6	+ 8	+ 7	+ 4	0	- 3	- 6	- 8
	30	- 8	- 9	- 6	- 3	+ 2	+ 6	+ 8	+ 9	+ 6	+ 3	- 2	- 6	- 8
Feb.	9	- 8	-10	- 8	- 5	0	+ 4	+ 8	+10	+ 8	+ 5	0	- 4	- 8
	19	- 7	-10	-10	- 8	- 3	+ 2	+ 7	+10	+10	+ 8	+ 3	- 2	- 7
Mar.	1	- 5	- 9	-11	-10	- 6	0	+ 5	+ 9	+11	+10	+ 6	0	- 5
	11	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8	+11	+11	+ 8	+ 3	- 3
	21	0	- 6	-10	-11	-10	- 5	0	+ 6	+10	+11	+10	+ 5	0
	31	+ 2	- 3	- 8	-11	-11	- 8	- 2	+ 3	+ 8	+11	+11	+ 8	+ 2
Apr.	10	+ 5	- 1	- 6	-10	-11	- 9	- 5	+ 1	+ 6	+10	+11	+ 9	+ 5
	20	+ 7	+ 2	- 4	- 8	-10	-10	- 7	- 2	+ 4	+ 8	+10	+10	+ 7
	30	+ 8	+ 4	- 1	- 6	- 9	-10	- 8	- 4	+ 1	+ 6	+ 9	+10	+ 8
May	10	+ 8	+ 5	+ 1	- 4	- 7	- 9	- 8	- 5	- 1	+ 4	+ 7	+ 9	+ 8
	20	+ 8	+ 6	+ 3	- 2	- 5	- 8	- 8	- 6	- 3	+ 2	+ 5	+ 8	+ 8
	30	+ 7	+ 6	+ 4	0	- 3	- 6	- 7	- 6	- 4	0	+ 3	+ 6	+ 7
June	9	+ 5	+ 6	+ 4	+ 2	- 1	- 4	- 5	- 6	- 4	- 2	+ 1	+ 4	+ 5
	19	+ 4	+ 5	+ 4	+ 3	0	- 2	- 4	- 5	- 4	- 3	0	+ 2	+ 4
	29	+ 2	+ 3	+ 4	+ 3	+ 1	- 1	- 2	- 3	- 4	- 3	- 1	+ 1	+ 2
July	9	+ 1	+ 2	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3	- 3	- 2	- 1	+ 1
June	29	+ 6	+14	+19	+18	+13	+ 4	- 6	-14	-19	-18	-13	- 4	+ 6
July	9	+ 2	+10	+16	+17	+14	+ 7	- 2	-10	-16	-17	-14	- 7	+ 2
	19	- 1	+ 7	+13	+15	+14	+ 8	+ 1	- 7	-13	-15	-14	- 8	- 1
	29	- 3	+ 4	+10	+13	+13	+ 9	+ 3	- 4	-10	-13	-13	- 9	- 3
Aug.	8	- 4	+ 1	+ 7	+10	+11	+ 9	+ 4	- 1	- 7	-10	-11	- 9	- 4
	18	- 5	- 1	+ 4	+ 7	+ 9	+ 8	+ 5	+ 1	- 4	- 7	- 9	- 8	- 5
	28	- 5	- 2	+ 1	+ 5	+ 7	+ 7	+ 5	+ 2	- 1	- 5	- 7	- 7	- 5
Sept.	7	- 5	- 3	0	+ 2	+ 4	+ 5	+ 5	+ 3	0	- 2	- 4	- 5	- 5
	17	- 4	- 3	- 1	0	+ 2	+ 3	+ 4	+ 3	+ 1	0	- 2	- 3	- 4
	27	- 2	- 3	- 2	- 1	+ 1	+ 2	+ 2	+ 3	+ 2	+ 1	- 1	- 2	- 2
Oct.	7	- 1	- 2	- 2	- 1	- 1	0	+ 1	+ 2	+ 2	+ 1	+ 1	0	- 1
	17	0	- 1	- 1	- 1	- 1	- 1	0	+ 1	+ 1	+ 1	+ 1	+ 1	0
	27	+ 1	0	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1	+ 1	+ 1
Nov.	6	+ 1	+ 1	+ 1	0	0	- 1	- 1	- 1	- 1	0	0	+ 1	+ 1
	16	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1	- 2	- 2	- 2	- 1	0	+ 1
	26	0	+ 2	+ 2	+ 3	+ 2	+ 1	0	- 2	- 2	- 3	- 2	- 1	0
Dec.	6	- 1	+ 1	+ 3	+ 4	+ 4	+ 3	+ 1	- 1	- 3	- 4	- 4	- 3	- 1
	16	- 3	- 1	+ 2	+ 4	+ 5	+ 4	+ 3	+ 1	- 2	- 4	- 5	- 4	- 3
	26	- 5	- 3	+ 1	+ 4	+ 6	+ 6	+ 5	+ 3	- 1	- 4	- 6	- 6	- 5
	36	- 7	- 5	- 1	+ 3	+ 6	+ 7	+ 7	+ 5	+ 1	- 3	- 6	- 7	- 7

The quantity J is given in this table in units of 0^s.00001, and is to be multiplied by $\tan^2\delta_0$ to give the second-order correction in the calculation of the apparent right ascension of a star.

The complete formula is :

$$\alpha = \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2\delta_0$$

FOR NORTHERN DECLINATIONS

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J' (0 ^{''} .0001)														
Jan.	0	- 2	- 1	0	- 1	- 2	- 4	- 6	- 7	- 8	- 7	- 6	- 4	- 2
	10	- 4	- 1	0	0	- 1	- 3	- 6	- 8	- 9	- 9	- 8	- 6	- 4
	20	- 6	- 3	- 1	0	- 1	- 2	- 5	- 8	-10	-11	-11	- 9	- 6
	30	- 9	- 5	- 2	0	0	- 2	- 4	- 8	-11	-13	-13	-11	- 9
Feb.	9	-11	- 8	- 4	- 1	0	- 1	- 3	- 7	-10	-13	-14	-14	-11
	19	-13	-10	- 6	- 3	0	0	- 2	- 5	- 9	-13	-15	-15	-13
Mar.	1	-13	-12	- 8	- 4	- 1	0	- 1	- 4	- 8	-12	-15	-16	-13
	11	-15	-14	-11	- 6	- 3	0	0	- 2	- 6	-11	-14	-17	-15
	21	-17	-16	-12	- 8	- 4	- 1	0	- 1	- 4	- 9	-13	-16	-17
	31	-17	-16	-14	-10	- 6	- 2	0	0	- 3	- 7	-11	-15	-17
Apr.	10	-16	-17	-15	-12	- 8	- 4	- 1	0	- 1	- 5	- 9	-13	-16
	20	-14	-16	-15	-13	- 9	- 5	- 2	0	- 1	- 3	- 7	-11	-14
	30	-12	-14	-14	-13	-10	- 6	- 3	- 1	0	- 2	- 5	- 8	-12
May	10	- 9	-12	-13	-13	-11	- 8	- 4	- 1	0	- 1	- 3	- 6	- 9
	20	- 7	-10	-12	-12	-11	- 8	- 5	- 2	0	0	- 1	- 4	- 7
	30	- 5	- 8	- 9	-10	-10	- 8	- 5	- 3	- 1	0	- 1	- 2	- 5
June	9	- 3	- 5	- 7	- 8	- 9	- 8	- 6	- 3	- 1	0	0	- 1	- 3
	19	- 2	- 3	- 5	- 6	- 7	- 7	- 6	- 4	- 2	- 1	0	0	- 2
	29	- 1	- 2	- 3	- 4	- 5	- 5	- 5	- 4	- 2	- 1	0	0	- 1
July	9	0	- 1	- 2	- 3	- 3	- 4	- 4	- 3	- 2	- 1	- 1	0	0
June	29	- 1	- 5	-11	-19	-25	-29	-28	-24	-18	-10	- 4	0	- 1
July	9	0	- 3	- 8	-15	-21	-25	-26	-23	-18	-12	- 5	- 1	0
	19	0	- 1	- 5	-11	-17	-21	-23	-22	-18	-12	- 6	- 2	0
	29	0	0	- 3	- 8	-13	-17	-20	-20	-17	-12	- 7	- 3	0
Aug.	8	- 1	0	- 2	- 5	- 9	-13	-16	-17	-15	-12	- 7	- 3	- 1
	18	- 1	0	- 1	- 3	- 6	- 9	-12	-13	-13	-11	- 7	- 4	- 1
	28	- 2	0	0	- 1	- 4	- 6	- 9	-10	-11	- 9	- 7	- 4	- 2
Sept.	7	- 2	- 1	0	0	- 2	- 4	- 6	- 7	- 8	- 8	- 6	- 4	- 2
	17	- 2	- 1	0	0	- 1	- 2	- 3	- 4	- 5	- 6	- 5	- 4	- 2
	27	- 3	- 2	- 1	0	0	- 1	- 1	- 2	- 3	- 4	- 4	- 3	- 3
Oct.	7	- 2	- 2	- 1	0	0	0	0	- 1	- 2	- 2	- 3	- 3	- 2
	17	- 2	- 2	- 1	- 1	0	0	0	0	0	- 1	- 1	- 2	- 2
	27	- 1	- 2	- 2	- 2	- 1	- 1	0	0	0	0	0	- 1	- 1
Nov.	6	- 1	- 1	- 2	- 2	- 2	- 2	- 1	- 1	0	0	0	0	- 1
	16	0	- 1	- 2	- 2	- 3	- 3	- 3	- 2	- 1	- 1	0	0	0
	26	0	0	- 1	- 2	- 3	- 4	- 4	- 4	- 3	- 2	- 1	0	0
Dec.	6	0	0	- 1	- 2	- 3	- 5	- 6	- 6	- 5	- 4	- 2	- 1	0
	16	- 1	0	0	- 1	- 3	- 5	- 7	- 7	- 7	- 6	- 4	- 2	- 1
	26	- 2	0	0	- 1	- 3	- 5	- 7	- 9	- 9	- 8	- 7	- 4	- 2
	36	- 4	- 1	0	0	- 2	- 5	- 8	-10	-11	-11	- 9	- 7	- 4

The quantity J' is given in this table in units of 0^{''}.0001, and is to be multiplied by $\tan \delta_0$ to give the second-order correction in the calculation of the apparent declination of a star.

The complete formula is :

$$\delta = \delta_0 + \tau\mu_0 + Aa' + Bb' + Cc' + Dd' + J' \tan \delta_0$$

FOR SOUTHERN DECLINATIONS

FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J (0 ^s .00001)														
Jan.	0	+ 3	+ 7	+10	+10	+ 7	+ 3	- 3	- 7	-10	-10	- 7	- 3	+ 3
	10	0	+ 4	+ 7	+ 9	+ 7	+ 4	0	- 4	- 7	- 9	- 7	- 4	0
	20	- 2	+ 2	+ 5	+ 7	+ 7	+ 5	+ 2	- 2	- 5	- 7	- 7	- 5	- 2
	30	- 3	0	+ 3	+ 5	+ 6	+ 5	+ 3	0	- 3	- 5	- 6	- 5	- 3
Feb.	9	- 4	- 2	+ 1	+ 3	+ 4	+ 4	+ 4	+ 2	- 1	- 3	- 4	- 4	- 4
	19	- 3	- 3	- 1	+ 1	+ 2	+ 3	+ 3	+ 3	+ 1	- 1	- 2	- 3	- 3
Mar.	1	- 3	- 3	- 2	- 1	+ 1	+ 2	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3
	11	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1
	21	0	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0
	31	+ 1	0	- 1	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1
Apr.	10	+ 3	+ 2	+ 1	- 1	- 2	- 2	- 3	- 2	- 1	+ 1	+ 2	+ 2	+ 3
	20	+ 3	+ 3	+ 2	+ 1	- 1	- 2	- 3	- 3	- 2	- 1	+ 1	+ 2	+ 3
	30	+ 3	+ 4	+ 4	+ 3	+ 1	- 2	- 3	- 4	- 4	- 3	- 1	+ 2	+ 3
May	10	+ 3	+ 5	+ 6	+ 5	+ 3	0	- 3	- 5	- 6	- 5	- 3	0	+ 3
	20	+ 2	+ 5	+ 7	+ 7	+ 5	+ 2	- 2	- 5	- 7	- 7	- 5	- 2	+ 2
	30	0	+ 4	+ 7	+ 9	+ 8	+ 4	0	- 4	- 7	- 9	- 8	- 4	0
June	9	- 2	+ 3	+ 7	+10	+10	+ 7	+ 2	- 3	- 7	-10	-10	- 7	- 2
	19	- 5	+ 1	+ 6	+10	+11	+ 9	+ 5	- 1	- 6	-10	-11	- 9	- 5
	29	- 8	- 2	+ 5	+10	+13	+12	+ 8	+ 2	- 5	-10	-13	-12	- 8
July	9	-11	- 5	+ 2	+ 9	+13	+14	+11	+ 5	- 2	- 9	-13	-14	-11
June	29	- 2	- 2	- 2	- 1	0	+ 1	+ 2	+ 2	+ 2	+ 1	0	- 1	- 2
July	9	- 3	- 3	- 3	- 2	0	+ 1	+ 3	+ 3	+ 3	+ 2	0	- 1	- 3
	19	- 3	- 4	- 4	- 3	- 1	+ 1	+ 3	+ 4	+ 4	+ 3	+ 1	- 1	- 3
	29	- 2	- 5	- 6	- 5	- 3	0	+ 2	+ 5	+ 6	+ 5	+ 3	0	- 2
Aug.	8	- 2	- 6	- 7	- 7	- 5	- 1	+ 2	+ 6	+ 7	+ 7	+ 5	+ 1	- 2
	18	- 1	- 5	- 8	- 9	- 7	- 3	+ 1	+ 5	+ 8	+ 9	+ 7	+ 3	- 1
	28	+ 1	- 4	- 8	-10	- 9	- 6	- 1	+ 4	+ 8	+10	+ 9	+ 6	+ 1
Sept.	7	+ 3	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8	+11	+11	+ 8	+ 3
	17	+ 6	- 1	- 7	-11	-13	-11	- 6	+ 1	+ 7	+11	+13	+11	+ 6
	27	+ 9	+ 2	- 5	-10	-13	-13	- 9	- 2	+ 5	+10	+13	+13	+ 9
Oct.	7	+11	+ 5	- 2	- 9	-13	-14	-11	- 5	+ 2	+ 9	+13	+14	+11
	17	+13	+ 8	+ 1	- 7	-13	-15	-13	- 8	- 1	+ 7	+13	+15	+13
	27	+14	+10	+ 4	- 4	-11	-14	-14	-10	- 4	+ 4	+11	+14	+14
Nov.	6	+15	+12	+ 7	- 1	- 8	-13	-15	-12	- 7	+ 1	+ 8	+13	+15
	16	+14	+13	+ 9	+ 2	- 5	-11	-14	-13	- 9	- 2	+ 5	+11	+14
	26	+13	+13	+10	+ 5	- 2	- 9	-13	-13	-10	- 5	+ 2	+ 9	+13
Dec.	6	+10	+12	+11	+ 7	+ 1	- 6	-10	-12	-11	- 7	- 1	+ 6	+10
	16	+ 8	+11	+11	+ 8	+ 3	- 3	- 8	-11	-11	- 8	- 3	+ 3	+ 8
	26	+ 5	+ 9	+10	+ 8	+ 5	0	- 5	- 9	-10	- 8	- 5	0	+ 5
	36	+ 3	+ 6	+ 8	+ 8	+ 5	+ 2	- 3	- 6	- 8	- 8	- 5	- 2	+ 3

The quantity J is given in this table in units of 0^s.00001, and is to be multiplied by $\tan^2\delta_0$ to give the second-order correction in the calculation of the apparent right ascension of a star.

The complete formula is :

$$\alpha = \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2\delta_0$$

FOR SOUTHERN DECLINATIONS
FOR 0^h EPHEMERIS TIME

R.A.		0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h
Date		12 ^h	13 ^h	14 ^h	15 ^h	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	24 ^h
J' (0".0001)														
Jan.	0	0	-2	-6	-10	-13	-15	-15	-13	-9	-6	-2	0	0
	10	0	-1	-3	-7	-10	-12	-13	-12	-10	-6	-3	-1	0
	20	0	0	-2	-4	-7	-9	-11	-11	-9	-7	-4	-2	0
	30	-1	0	-1	-2	-4	-6	-8	-9	-8	-7	-4	-2	-
Feb.	9	-1	0	0	-1	-2	-4	-5	-7	-7	-6	-5	-3	-1
	19	-2	-1	0	0	-1	-2	-3	-4	-5	-5	-5	-3	-2
Mar.	1	-2	-1	-1	0	0	-1	-2	-3	-3	-4	-4	-3	-2
	11	-3	-2	-1	-1	0	0	0	-1	-2	-3	-3	-3	-3
	21	-3	-3	-2	-2	-1	0	0	0	-1	-1	-2	-3	-3
	31	-3	-3	-3	-3	-2	-1	0	0	0	-1	-1	-2	-3
Apr.	10	-2	-3	-4	-4	-3	-2	-1	-1	0	0	-1	-1	-2
	20	-2	-3	-4	-5	-5	-4	-3	-2	-1	0	0	-1	-2
	30	-1	-3	-5	-6	-7	-7	-5	-4	-2	-1	0	0	-1
May	10	-1	-2	-4	-6	-8	-8	-8	-6	-4	-2	0	0	-1
	20	0	-2	-4	-7	-9	-10	-10	-9	-7	-4	-2	0	0
	30	0	-1	-3	-6	-10	-12	-13	-12	-10	-7	-3	-1	0
June	9	0	0	-2	-6	-10	-13	-15	-15	-13	-9	-5	-2	0
	19	-1	0	-1	-5	-9	-13	-16	-17	-16	-12	-8	-4	-1
	29	-2	0	-1	-4	-8	-13	-17	-19	-19	-16	-11	-6	-2
July	9	-4	-1	0	-2	-7	-12	-17	-20	-21	-18	-14	-9	-4
June	29	-2	-1	-1	0	0	0	-1	-2	-3	-3	-3	-3	-2
July	9	-4	-3	-1	0	0	0	-1	-2	-3	-4	-5	-5	-4
	19	-6	-4	-3	-1	0	0	-1	-2	-4	-6	-6	-7	-6
	29	-8	-7	-4	-2	-1	0	-1	-2	-4	-7	-8	-9	-8
Aug.	8	-11	-9	-7	-4	-1	0	0	-2	-4	-7	-10	-11	-11
	18	-13	-12	-9	-6	-3	-1	0	-1	-4	-7	-10	-13	-13
	28	-15	-14	-12	-8	-4	-1	0	-1	-3	-7	-11	-14	-15
Sept.	7	-17	-17	-15	-11	-7	-3	0	0	-2	-6	-11	-15	-17
	17	-18	-19	-18	-14	-9	-4	-1	0	-1	-5	-10	-15	-18
	27	-18	-20	-20	-17	-12	-7	-2	0	-1	-4	-8	-14	-18
Oct.	7	-17	-21	-21	-19	-15	-9	-4	-1	0	-2	-7	-12	-17
	17	-16	-21	-22	-21	-17	-12	-6	-2	0	-1	-5	-11	-16
	27	-14	-19	-22	-22	-19	-14	-8	-3	0	0	-3	-8	-14
Nov.	6	-12	-17	-21	-22	-20	-16	-10	-5	-1	0	-2	-6	-12
	16	-9	-15	-19	-21	-21	-17	-12	-7	-2	0	-1	-4	-9
	26	-7	-12	-17	-20	-20	-18	-13	-8	-4	-1	0	-2	-7
Dec.	6	-4	-9	-13	-17	-18	-17	-14	-10	-5	-1	0	-1	-4
	16	-2	-6	-10	-14	-16	-16	-14	-10	-6	-2	0	0	-2
	26	-1	-4	-8	-11	-14	-15	-14	-11	-7	-3	-1	0	-1
	36	0	-2	-5	-8	-11	-12	-12	-10	-7	-4	-2	0	0

The quantity J' is given in this table in units of 0".0001, and is to be multiplied by $\tan \delta_0$ to give the second-order correction in the calculation of the apparent declination of a star.

The complete formula is :

$$\delta = \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta_0$$

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
30 Psc	4.7	M3	0 00 16.0	- 6 11 51	δ Phe	4.0	K0	1 29 52.7	-49 14 38
2 Cet	4.6	A0	0 02 03.0	-17 31 11	ν And	4.2	G0	1 34 51.1	+41 14 28
33 Psc	4.7	K0	0 03 38.7	- 5 53 32	51 And	3.8	K0	1 35 57.3	+48 27 42
α And	2.1	A0p	0 06 40.6	+28 54 30	α Eri	0.6	B5	1 36 29.2	-57 24 15
β Cas	2.4	F5	0 07 24.3	+58 58 04	ν Psc	4.7	K0	1 39 42.7	+ 5 19 16
ε Phe	3.9	K0	0 07 44.4	-45 55 46	φ Per	4.2	B0p	1 41 34.8	+50 31 24
γ Peg	2.9	B2	0 11 32.0	+15 00 01	τ Cet	3.6	K0	1 42 32.0	-16 06 38
7 Cet	4.7	M1	0 12 57.9	-19 06 56	ο Psc	4.5	K0	1 43 38.9	+ 8 59 32
θ And	4.4	A2	0 15 21.6	+38 29 54	ζ Cet	3.9	K0	1 49 49.8	-10 29 51
σ And	4.5	A2	0 16 35.8	+36 36 09	α Tri	3.6	F5	1 51 11.6	+29 25 08
ι Cet	3.7	K0	0 17 44.7	- 9 00 24	γ Ari	4.7	A0p	1 51 42.9	+19 07 57
ζ Tuc	4.3	F8	0 18 21.8	-65 04 07	ε Cas	3.4	B3	1 52 00.0	+63 30 31
β Hyi	2.9	G0	0 24 02.6	-77 26 24	ψ Phe	4.4	M3	1 52 19.4	-46 27 50
κ Phe	3.9	A3	0 24 35.0	-43 51 47	β Ari	2.7	A5	1 52 48.7	+20 38 51
α Phe	2.4	K0	0 24 39.4	-42 29 07	η ² Hyi	4.7	K0	1 54 05.7	-67 48 33
β Tuc	4.5	A2	0 30 03.2	-63 08 51	χ Eri	3.7	G5	1 54 40.5	-51 46 22
κ Cas	4.2	B0	0 31 06.5	+62 45 00	-47°597	4.7	G5	1 55 51.5	-47 32 45
π And	4.5	B3	0 35 06.7	+33 32 16	α Hyi	3.0	F0	1 57 43.8	-61 43 48
ζ Cas	3.7	B3	0 35 07.3	+53 42 56	ν Cet	4.2	M0	1 58 26.9	-21 14 13
ε And	4.5	G5	0 36 48.4	+29 07 58	48 Cas	4.6	A3	1 59 12.6	+70 44 54
δ And	3.5	K2	0 37 33.4	+30 40 50	α Psc	4.3	A2p	2 00 20.2	+ 2 36 18
α Cas	2.3	K0	0 38 37.3	+56 21 24	50 Cas	4.1	A2	2 00 34.7	+72 15 46
μ Phe	4.6	K0	0 39 46.1	-46 15 58	γ ¹ And	2.3	K0	2 01 51.9	+42 10 20
η Phe	4.5	A0	0 41 52.5	-57 38 38	ν For	4.7	A0p	2 03 00.7	-29 27 17
β Cet	2.2	K0	0 41 56.0	-18 10 03	α U Mi	2.1	F8	2 00 56.6	+89 06 43
ο Cas	4.7	B2	0 42 52.6	+48 06 15	α Ari	2.2	K2	2 05 18.5	+23 18 26
ζ And	4.3	K0	0 45 35.1	+24 05 17	β Tri	3.1	A5	2 07 34.4	+34 49 55
δ Psc	4.5	K5	0 46 58.0	+ 7 24 21	ξ ¹ Cet	4.5	G5	2 11 14.8	+ 8 41 34
η Cas	3.6	F8	0 47 05.2	+57 38 28	φ Eri	3.8	B8	2 15 19.8	-51 39 52
ν And	4.4	B3	0 47 59.1	+40 53 58	γ Tri	4.1	A0	2 15 20.7	+33 41 44
γ Cas	Var.	B0p	0 54 42.1	+60 32 19	ο Cet	2-10	M5e	2 17 40.6	- 3 07 36
μ And	3.9	A2	0 54 54.8	+38 19 15	δ Hyi	4.3	A2	2 21 09.4	-68 48 33
η And	4.6	G5	0 55 26.4	+23 14 24	κ Eri	4.4	B5	2 25 46.5	-47 51 05
α Scl	4.4	B5	0 57 01.0	-29 32 08	ξ ² Cet	4.3	A0	2 26 24.1	+ 8 18 47
ε Psc	4.4	K0	1 01 13.7	+ 7 42 46	ι Cas	4.6	A5p	2 26 19.2	+67 15 20
43 H. Cep	4.5	K0	1 03 52.9	+86 04 52	δ Cet	4.0	B2	2 37 47.3	+ 0 11 14
β Phe	3.3	K0	1 04 36.8	-46 53 42	s Eri	4.5	A2	2 38 32.5	-43 01 58
η Cet	3.6	K0	1 06 55.7	-10 21 24	ε Hyi	4.3	B9	2 39 04.5	-68 24 29
ζ Phe	4.1	B8	1 07 00.0	-55 25 19	ι Eri	4.1	K0	2 39 21.9	-39 59 45
φ And	4.3	B8	1 07 34.6	+47 03 59	35 Ari	4.6	B3	2 41 30.6	+27 34 04
β And	2.4	M0	1 07 52.6	+35 26 46	γ Cet	3.6	A2	2 41 35.3	+ 3 05 51
θ Cas	4.5	A5	1 09 04.8	+54 58 29	θ Per	4.2	F8	2 41 56.1	+49 05 24
τ Psc	4.7	K0	1 09 50.2	+29 54 54	π Cet	4.4	B5	2 42 33.0	-13 59 51
φ Psc	4.6	K0	1 11 57.1	+24 24 33	μ Cet	4.4	F0	2 43 09.3	+ 9 58 33
ν Psc	4.7	A2	1 17 38.8	+27 05 28	1 Eri	4.6	F5	2 43 33.7	-18 42 41
θ Cet	3.8	K0	1 22 22.3	- 8 21 12	39 Ari	4.6	K0	2 45 56.3	+29 06 40
δ Cas	2.8	A5	1 23 38.4	+60 03 52	β For	4.5	K0	2 47 42.5	-32 32 37
γ Phe	3.4	K5	1 26 56.0	-43 29 13	41 Ari	3.7	B8	2 48 02.1	+27 07 32
η Psc	3.7	G5	1 29 42.8	+15 10 34	η Per	3.9	K0	2 48 16.5	+55 45 36

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
16 Per	4.3	F0	2 48 29.5	+38 11 02	γ Hyi	3.2	M0	3 47 43.9	-74 20 26
17 Per	4.7	K5	2 49 28.5	+34 55 30	g Eri	4.2	K0	3 48 13.1	-36 17 58
ν Hyi	4.7	K2	2 50 39.9	-75 12 06	ζ Per	2.9	B1	3 52 03.2	+31 47 13
τ Per	4.1	G0, A5	2 51 54.3	+52 37 44	ε Per	3.0	B1	3 55 38.0	+39 54 59
η Eri	4.0	K0	2 54 48.8	- 9 01 43	γ Eri	3.2	K5	3 56 29.3	-13 36 05
π Per	4.6	A2	2 56 38.6	+39 31 55	ξ Per	4.0	Oe5	3 56 49.1	+35 41 52
θ Eri	3.4	A2	2 57 00.5	-40 26 10	δ Ret	4.4	M0	3 58 13.1	-61 29 35
ε Ari	4.6	A2	2 57 19.2	+21 12 34	36 Eri	4.7	A0p	3 58 31.0	-24 06 32
λ Cet	4.7	B5	2 57 56.6	+ 8 46 37	λ Tau	3.9	B3	3 58 50.9	+12 23 54
α Cet	2.8	M0	3 00 33.1	+ 3 57 41	γ Ret	4.5	M5	4 00 24.9	-62 15 04
τ ³ Eri	4.2	A3	3 00 56.1	-23 45 10	ν Tau	3.9	A0	4 01 23.9	+ 5 53 57
γ Per	3.1	F5, A3	3 02 23.6	+53 22 43	37 Tau	4.5	K0	4 02 44.4	+21 59 35
ρ Per	3-4	M3	3 03 03.3	+38 42 49	λ Per	4.3	A0	4 04 07.0	+50 15 49
β Per	2-3	B8	3 06 00.8	+40 49 47	48 Per	4.0	B3p	4 06 15.5	+47 37 34
ι Per	4.2	G0	3 06 40.4	+49 29 20	ο ¹ Eri	4.1	F2	4 10 15.2	- 6 55 21
κ Per	4.0	K0	3 07 15.7	+44 44 01	μ Per	4.3	G0	4 12 28.0	+48 19 38
δ Ari	4.5	K0	3 09 44.3	+19 36 11	α Hor	3.8	K0	4 12 54.4	-42 22 30
α For	3.9	F8	3 10 40.1	-29 06 59	40 Eri	4.5	G5	4 13 45.1	- 7 42 11
16 Eri	3.9	M3	3 18 02.9	-21 52 37	μ Tau	4.3	B3	4 13 44.4	+ 8 48 40
+28°516	4.7	K5	3 18 20.3	+28 55 48	α Ret	3.4	G5	4 13 59.7	-62 33 22
82 G. Eri	4.3	G5	3 18 36.7	-43 11 42	γ Dor	4.4	F5	4 15 09.6	-51 34 09
α Per	1.9	F5	3 21 57.4	+49 44 43	ε Ret	4.4	K2	4 15 54.6	-59 22 51
ο Tau	3.8	G5	3 23 02.1	+ 8 54 50	b Per	4.6	A2	4 15 45.3	+50 12 58
ξ Tau	3.7	B8	3 25 22.6	+ 9 37 08	41 Eri	3.6	B9	4 16 38.7	-33 52 41
2 H. Cam	4.4	B9p	3 26 22.8	+59 49 38	γ Tau	3.9	K0	4 17 54.7	+15 32 58
34 Per	4.7	B5	3 26 59.9	+49 23 46	δ Tau	3.9	K0	4 21 01.7	+17 27 59
σ Per	4.5	K0	3 28 14.3	+47 52 58	43 Eri	4.1	K5	4 22 47.7	-34 05 33
5 Tau	4.3	K0	3 29 02.9	+12 49 29	κ Tau	4.4	A3	4 23 23.9	+22 13 11
ε Eri	3.8	K0	3 31 22.4	- 9 34 08	68 Tau	4.2	A2	4 23 34.6	+17 51 14
τ ⁵ Eri	4.3	B8	3 32 19.7	-21 44 33	ν Tau	4.4	A5	4 24 19.8	+22 44 25
ψ Per	4.3	B5p	3 34 08.1	+48 05 04	71 Tau	4.6	A5	4 24 27.8	+15 32 41
10 Tau	4.4	G5	3 35 11.2	+ 0 17 53	77 Tau	4.0	K0	4 26 41.2	+15 53 25
y Eri	4.6	K0	3 35 54.5	-40 22 56	ε Tau	3.6	K0	4 26 41.2	+19 06 31
δ Per	3.1	B5	3 40 34.0	+47 41 01	θ ² Tau	3.6	F0	4 26 46.5	+15 47 57
h Eri	4.6	K2	3 41 36.6	-37 25 01	ρ Tau	4.7	A5	4 31 58.4	+14 46 35
δ Eri	3.7	K0	3 41 39.9	- 9 52 27	50 Eri	4.6	K0	4 32 12.9	-29 49 56
ο Per	3.9	B1	3 42 14.6	+32 11 06	α Dor	3.5	A0p	4 33 16.9	-55 06 46
17 Tau	3.8	B5p	3 42 54.7	+24 00 39	88 Tau	4.4	A3	4 33 50.3	+10 05 40
ν Per	3.9	F5	3 42 56.7	+42 28 33	α Tau	1.1	K5	4 34 01.5	+16 26 40
19 Tau	4.4	B5	3 43 14.4	+24 21 54	ν Eri	3.9	K0	4 34 16.0	-30 37 44
β Ret	3.8	K0	3 43 46.7	-64 54 38	58 Per	4.5	K0, A3	4 34 23.9	+41 11 55
20 Tau	4.0	B5	3 43 51.5	+24 15 57	ν Eri	4.1	B2	4 34 40.1	- 3 25 07
23 Tau	4.2	B5	3 44 21.8	+23 50 49	90 Tau	4.3	A3	4 36 18.6	+12 26 46
π Eri	4.6	M2	3 44 34.8	-12 12 15	53 Eri	4.0	K0	4 36 40.1	-14 22 03
τ ⁶ Eri	4.3	F8	3 45 25.6	-23 20 46	54 Eri	4.5	M4	4 38 59.8	-19 44 02
η Tau	3.0	B5p	3 45 31.1	+24 00 16	α Cae	4.5	F2	4 39 29.8	-41 55 34
+65°369	4.7	M1	3 46 28.7	+65 25 34	τ Tau	4.3	B5	4 40 15.7	+22 53 43
γ Cam	4.7	A0	3 46 50.6	+71 13 59	μ Eri	4.2	B5	4 43 51.0	- 3 18 50
27 Tau	3.8	B8	3 47 11.7	+23 57 14	π ³ Ori	3.3	F8	4 48 02.8	+ 6 54 18

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
2 Ori	4.3	A0	4 48 48.7	+ 8 50 42	ε Ori	1.7	B0	5 34 32.3	- 1 13 18
π ¹ Ori	3.8	B3	4 49 26.8	+ 5 33 00	40 Ori	4.4	K0	5 35 05.5	+ 9 16 27
α Cam	4.4	B0	4 50 45.4	+66 17 21	ζ Tau	3.0	B3 _p	5 35 40.3	+21 07 26
ω Eri	4.4	F0	4 51 16.3	- 5 30 24	σ Ori	3.8	B0	5 37 05.3	- 2 37 04
π ⁵ Ori	3.9	B3	4 52 31.8	+ 2 23 17	ω Ori	4.5	B3 _p	5 37 26.5	+ 4 06 15
7 Ori	4.7	A0	4 53 04.6	+10 05 59	α Col	2.7	B5 _p	5 38 27.2	-34 05 27
9 Ori	4.3	K0	4 54 30.8	+13 27 49	ζ Ori	2.0	B0	5 39 05.6	- 1 57 31
7 Cam	4.4	A2	4 54 38.1	+53 42 05	γ Lep	3.8	F8	5 43 05.2	-22 27 29
ι Aur	2.9	K2	4 54 50.5	+33 06 56	δ Dor	4.5	A5	5 44 42.8	-65 44 52
10 Ori	4.7	K0	4 56 50.2	+ 1 39 53	ζ Lep	3.7	A2	5 45 27.5	-14 49 59
ε Aur	3-4	F5 _p	4 59 35.8	+43 46 35	κ Ori	2.2	B0	5 46 11.4	- 9 40 48
ζ Aur	3.9	K0, B1	5 00 10.1	+41 01 46	β Pic	3.9	A3	5 46 30.1	-51 04 40
β Cam	4.2	G0 _p	5 00 28.5	+60 23 47	τ Aur	4.6	K0	5 46 53.2	+39 10 18
ι Tau	4.7	A5	5 01 07.2	+21 32 40	γ Pic	4.4	K0	5 49 13.6	-56 10 27
11 Ori	4.6	B9	5 02 40.9	+15 21 35	ν Aur	4.2	K0	5 49 12.1	+39 08 27
γ Cae	4.6	K0	5 03 13.1	-35 31 39	β Col	3.2	K0	5 49 47.7	-35 46 48
ε Lep	3.3	K5	5 04 03.8	-22 24 51	δ Lep	3.9	K0	5 49 54.1	-20 52 50
η Aur	3.3	B3	5 04 11.8	+41 11 30	136 Tau	4.5	A0	5 51 15.1	+27 36 22
β Eri	2.9	A3	5 06 13.6	- 5 07 40	χ Ori	4.6	F8	5 52 25.6	+20 16 18
λ Eri	4.3	B2	5 07 34.0	- 8 47 42	α Ori	0-1	M0	5 53 23.1	+ 7 24 08
ι Lep	4.5	B8	5 10 45.4	-11 54 27	-63°498	4.5	K0	5 53 50.8	-63 05 59
μ Lep	3.3	A0 _p	5 11 26.9	-16 14 36	η Lep	3.8	F0	5 54 54.1	-14 10 21
ρ Ori	4.6	K0	5 11 33.9	+ 2 49 24	γ Col	4.4	B3	5 56 22.0	-35 17 09
κ Lep	4.5	B8	5 11 42.4	-12 58 45	δ Aur	3.9	K0	5 56 48.6	+54 17 04
β Ori	0.3	B8 _p	5 12 57.1	- 8 14 19	β Aur	2.1	A0 _p	5 57 06.4	+44 56 46
α Aur	0.2	G0	5 14 14.9	+45 57 59	θ Aur	2.7	A0 _p	5 57 28.2	+37 12 43
τ Ori	3.7	B5	5 16 00.2	- 6 52 43	π Aur	4.6	M3	5 57 29.1	+45 56 09
λ Lep	4.3	B1	5 18 03.2	-13 12 35	η Col	4.0	K0	5 58 08.1	-42 48 59
-21°1135	4.7	A0	5 19 02.3	-21 16 18	-3°1256	4.7	K0	5 58 24.2	- 3 04 27
22 Ori	4.6	B3	5 20 04.6	- 0 24 49	μ Ori	4.2	A2	6 00 34.0	+ 9 38 56
29 Ori	4.2	K0	5 22 21.4	- 7 50 13	62 Ori	4.7	B2 _p	6 01 57.6	+20 08 27
η Ori	3.4	B1	5 22 49.0	- 2 25 34	1 Gem	4.3	G5	6 02 06.8	+23 16 00
25 Ori	4.7	B3 _p	5 23 02.0	+ 1 49 03	θ Lep	4.7	A0	6 04 39.7	-14 55 52
γ Ori	1.7	B2	5 23 21.6	+ 6 19 16	ν Ori	4.4	B2	6 05 41.2	+14 46 26
β Tau	1.8	B8	5 24 12.3	+28 34 53	ξ Ori	4.3	B3	6 10 03.8	+14 13 04
ψ Ori	4.7	B2	5 25 06.4	+ 3 04 07	η Gem	3-4	M0	6 12 53.1	+22 31 05
β Lep	3.0	G0	5 26 49.9	-20 47 05	5 Mon	4.1	K0	6 13 14.7	- 6 15 48
32 Ori	4.3	B3	5 29 01.0	+ 5 55 28	κ Aur	4.4	K0	6 13 16.5	+29 30 43
ε Col	3.9	K0	5 30 02.4	-35 29 38	κ Col	4.5	K0	6 15 22.6	-35 07 43
119 Tau	4.7	M2	5 30 16.6	+18 34 17	22 H. Cam	4.7	A0	6 15 12.8	+69 20 04
δ Ori	2.5	B0	5 30 19.2	- 0 19 20	2 Lyn	4.4	A0	6 16 42.8	+59 01 31
ν Ori	4.6	B3	5 30 20.0	- 7 19 28	ζ C Ma	3.1	B3	6 19 02.7	-30 02 52
α Lep	2.7	F0	5 31 16.4	-17 50 41	δ Col	4.0	G5	6 20 54.4	-33 25 08
φ ¹ Ori	4.5	B0	5 33 00.5	+ 9 28 07	μ Gem	3.2	M0	6 20 57.8	+22 31 56
β Dor	4-6	F5 _p	5 33 20.2	-62 30 41	β C Ma	2.0	B1	6 21 14.8	-17 56 18
λ Ori	3.7	Oe5	5 33 19.1	+ 9 54 48	ε Mon	4.5	A5	6 22 01.1	+ 4 36 40
-6°1234	4.7	B1	5 33 25.8	- 6 01 21	α Car	-0.9	F0	6 23 13.1	-52 40 38
42 Ori	4.6	B3	5 33 45.4	- 4 51 31	λ C Ma	4.5	B5	6 26 56.7	-32 33 30
ι Ori	2.9	Oe5	5 33 49.1	- 5 55 49	ν Gem	4.1	B5	6 27 00.2	+20 14 04

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
β Mon	4.6	B2e	6 27 12.9	- 7 00 38	21 Lyn	4.4	A0	7 24 13.8	+49 16 44
4 C Ma	4.3	B1	6 30 28.8	-23 23 37	β C Mi	3.1	B8	7 25 21.7	+ 8 21 26
13 Mon	4.5	A0p	6 31 07.2	+ 7 21 31	γ C Mi	4.6	K0	7 26 22.0	+ 8 59 38
ξ^2 C Ma	4.5	A0	6 33 40.3	-22 56 15	ρ Gem	4.2	F0	7 26 59.5	+31 51 06
N Car	4.4	A0	6 34 14.9	-52 56 53	σ Pup	3.3	K5	7 28 11.0	-43 14 02
ν C Ma	4.1	K0	6 35 14.6	-19 13 36	α Gem	1.6	A0	7 32 29.7	+31 57 43
γ Gem	1.9	A0	6 35 48.4	+16 25 44	108 G. Pup	4.5	F8	7 32 38.4	-22 13 26
8 C Ma	4.6	K0	6 36 26.3	-18 12 28	ν Gem	4.2	K5	7 33 53.5	+26 58 14
ν Pup	3.2	B8	6 36 45.0	-43 09 58	p Pup	4.5	B8	7 34 03.3	-28 17 44
S Mon	4.7	Oe5	6 39 09.6	+ 9 55 40	f Pup	4.6	B8	7 36 08.8	-34 53 36
ϵ Gem	3.2	G5	6 41 54.2	+25 09 55	m Pup	4.6	B8	7 36 55.6	-25 17 20
30 Gem	4.6	K0	6 42 07.6	+13 15 46	k Pup	4.5	B8	7 37 28.2	-26 43 33
ξ Gem	3.4	F5	6 43 26.3	+12 55 58	α C Mi	0.5	F5	7 37 34.5	+ 5 18 39
α C Ma	-1.6	A0	6 43 41.7	-16 40 10	α Mon	4.1	K0	7 39 40.2	- 9 28 23
18 Mon	4.7	K0	6 46 08.4	+ 2 26 59	σ Gem	4.3	K0	7 41 15.1	+28 57 54
α Pic	3.3	A5	6 47 51.2	-61 54 20	ζ Vol	3.9	K0	7 42 14.3	-72 31 38
κ C Ma	3.8	B2p	6 48 36.5	-32 28 10	3 Pup	4.1	A2p	7 42 28.9	-28 52 30
τ Pup	2.8	K0	6 49 07.0	-50 34 29	κ Gem	3.7	G5	7 42 27.5	+24 28 43
A Car	4.4	G5	6 49 08.3	-53 34 59	β Gem	1.2	K0	7 43 18.0	+28 06 27
θ Gem	3.6	A2	6 50 36.9	+34 00 10	c Pup	3.7	K5	7 44 04.7	-37 53 16
15 C Ma	4.7	B1	6 52 07.3	-20 10 56	o Pup	4.6	B2	7 46 42.8	-25 51 15
θ C Ma	4.2	K2	6 52 39.4	-11 59 46	Q Pup	4.6	K0	7 47 21.3	-46 59 37
16 C Ma	4.1	K2p	6 52 45.7	-24 08 30	ξ Pup	3.5	G0p	7 47 54.3	-24 46 33
38 Gem	4.7	F0	6 52 47.0	+13 13 16	P Pup	4.2	B0	7 48 13.9	-46 17 22
π C Ma	4.6	F5	6 54 11.5	-20 05 36	a Pup	3.8	G5	7 51 04.9	-40 29 24
15 Lyn	4.5	G0	6 54 25.5	+58 28 06	b Pup	4.5	B3	7 51 28.5	-38 46 36
ι C Ma	4.4	B5	6 54 39.9	-17 00 37	J Pup	4.3	B1	7 52 20.0	-48 00 59
24 H. Cam	4.7	K5	6 55 17.0	+77 01 24	11 Pup	4.3	F8	7 55 26.4	-22 47 28
ϵ C Ma	1.6	B1	6 57 19.7	-28 55 34	χ Car	3.6	B3	7 55 56.4	-52 53 35
σ C Ma	3.7	K5	7 00 24.3	-27 53 12	V Pup	4-5	B1p	7 57 17.4	-49 09 17
ϕ^2 C Ma	3.1	B5p	7 01 38.8	-23 47 03	232 G. Pup	4.6	A2	7 58 23.3	-18 18 28
ζ Gem	3.9	G0p	7 02 09.2	+20 37 13	+2 $^{\circ}$ 1854	4.5	K0	8 00 32.9	+ 2 25 35
γ C Ma	4.1	B5	7 02 15.9	-15 35 00	ζ Pup	2.3	Od	8 02 25.4	-39 54 34
δ C Ma	2.0	F8p	7 07 02.9	-26 20 23	ρ Pup	2.9	F5	8 06 08.3	-24 12 29
γ^2 Vol	3.9	K0	7 09 02.1	-70 26 44	ζ Mon	4.4	G0	8 06 56.1	- 2 53 12
τ Gem	4.5	K0	7 09 02.4	+30 18 03	16 Pup	4.3	B3	8 07 33.2	-19 08 51
δ Mon	4.1	A0	7 10 10.7	- 0 26 12	ϵ Vol	4.5	B5	8 07 49.9	-68 31 13
I Pup	4.5	F0	7 11 37.1	-46 42 13	γ^2 Vel	1.9	Oap	8 08 30.9	-47 14 19
L ² Pup	3-6	M5e	7 12 31.8	-44 35 07	19 Pup	4.7	K0	8 09 43.4	-12 49 41
27 C Ma	4.7	B5p	7 12 54.4	-26 17 40	h^1 Pup	4.4	K5	8 10 10.7	-39 31 10
ω C Ma	3.8	B3p	7 13 28.3	-26 42 52	h^2 Pup	4.4	K0	8 12 52.5	-40 14 47
π Pup	2.7	K5	7 15 58.6	-37 02 14	β Cnc	3.8	K2	8 14 43.6	+ 9 17 19
λ Gem	3.6	A2	7 16 11.9	+16 36 05	q Pup	4.4	A5	8 17 19.2	-36 33 23
δ Vol	4.0	F5	7 16 51.1	-67 53 49	α Cha	4.1	F5	8 19 24.4	-76 48 57
ν Pup	4.7	B3	7 17 08.0	-36 40 23	31 Lyn	4.4	K5	8 20 35.0	+43 17 44
30 C Ma	4.4	Oe5	7 17 20.3	-24 53 35	θ Cha	4.3	K0	8 21 39.9	-77 22 43
δ Gem	3.5	F0	7 18 09.2	-22 02 41	ϵ Car	1.7	K0, B	8 21 50.3	-59 24 10
η C Ma	2.4	B5p	7 22 47.4	+29 14 16	Br. 1197	3.9	A0	8 24 00.7	- 3 47 52
ι Gem	3.9	K0	7 23 40.8	+27 51 55	β Vol	3.6	K0	8 25 23.1	-66 01 36

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			^h ^m ^s	[°] ['] ^{''}				^h ^m ^s	[°] ['] ^{''}
o U Ma	3.5	G0	8 27 32.3	+60 49 49	23 U Ma	3.7	F0	9 28 56.8	+63 12 27
δ Hya	4.2	A0	8 35 54.6	+ 5 49 11	ψ Vel	3.6	F5	9 29 23.9	-40 19 18
e Vel	4.1	A5	8 36 29.0	-42 52 23	λ Leo	4.5	K5	9 29 50.4	+23 06 52
σ Hya	4.5	K0	8 37 02.0	+ 3 27 30	N Vel	3.0	K5	9 30 13.1	-56 53 18
β Pyx	4.0	G5	8 38 48.6	-35 11 25	32 Hya	4.5	A3	9 30 18.0	- 1 02 18
o Vel	3.7	B3	8 39 20.9	-52 48 15	θ U Ma	3.3	F8 _p	9 30 39.6	+51 49 44
53 G. Vel	4.1	F5 _p	8 39 31.8	-46 31 51	R Car	4-10	M5 _e	9 31 24.9	-62 38 32
d Car	4.4	B2	8 39 53.4	-59 38 35	24 U Ma	4.6	G0	9 31 35.8	+69 58 36
γ Cnc	4.7	A0	8 41 22.7	+21 35 18	10 L Mi	4.6	G5	9 32 12.4	+36 32 42
η Hya	4.3	B3	8 41 30.0	+ 3 31 05	26 U Ma	4.6	A0	9 32 34.4	+52 11 57
31 Mon	4.7	G0	8 42 03.2	- 7 06 50	1 H. Dra	4.6	K2	9 32 31.5	+81 28 28
α Pyx	3.7	B2	8 42 15.9	-33 04 00	h Car	4.2	B5	9 33 29.2	-59 04 55
δ Cnc	4.2	K0	8 42 48.7	+18 16 36	M Vel	4.5	A5	9 35 38.7	-49 12 24
d Vel	4.1	G5	8 43 13.2	-42 31 44	ι Hya	4.1	K0	9 38 10.3	- 0 59 32
δ Vel	2.0	A0	8 43 47.6	-54 35 13	m Car	4.7	B9	9 38 26.1	-61 10 42
ι Cnc	4.2	G5	8 44 42.2	+28 52 55	o Leo	3.8	F5, A3	9 39 23.4	+10 02 36
12 Hya	4.4	G5	8 44 49.0	-13 25 34	I Hya	4.7	B2 _p	9 39 46.6	-23 26 27
a Vel	4.1	A0	8 44 54.5	-45 55 13	ε Leo	3.1	G0 _p	9 43 58.9	+23 55 37
ε Hya	3.5	F8	8 45 01.8	+ 6 32 27	l Car	4-5	G0	9 44 20.4	-62 21 19
f Car	4.6	B3	8 45 51.4	-56 38 53	υ Car	3.1	F0	9 46 16.7	-64 55 06
ρ Hya	4.4	A0	8 46 41.1	+ 5 57 38	υ U Ma	3.9	F0	9 48 39.5	+59 11 42
γ Pyx	4.2	K2	8 49 07.9	-27 35 12	39 Hya	4.3	K0	9 49 53.4	-14 41 28
ζ Hya	3.3	K0	8 53 39.0	+ 6 04 20	φ U Ma	4.5	A2	9 49 52.4	+54 13 10
c Car	4.0	B8	8 54 18.1	-60 31 05	m Vel	4.6	G5	9 50 24.1	-46 23 33
α Cnc	4.3	A3	8 56 41.0	+11 59 11	μ Leo	4.1	K0	9 50 53.4	+26 09 47
ι U Ma	3.1	A5	8 56 57.4	+48 10 21	φ Vel	3.7	B5	9 55 42.1	-54 24 37
10 U Ma	4.1	F5	8 58 30.3	+41 54 53	υ ² Hya	4.7	B8	10 03 31.0	-12 54 15
91 G. Vel	4.4	F8	8 58 51.4	-41 07 28	21 L Mi	4.5	A5	10 05 29.3	+35 24 23
κ U Ma	3.7	A0	9 01 22.8	+47 17 18	η Leo	3.6	A0 _p	10 05 32.1	+16 55 27
α Vol	4.2	A5	9 01 55.8	-66 15 51	31 Leo	4.6	K2	10 06 09.3	+10 09 36
c Vel	3.7	K0	9 03 00.9	-46 57 57	15 Sex	4.5	A0	10 06 14.9	- 0 12 35
Pi.8 ^b 245	4.7	G5	9 04 26.2	+38 35 07	α Leo	1.3	B8	10 06 37.0	+12 07 45
G Car	4.5	F5	9 05 04.6	-72 28 12	λ Hya	3.8	K0	10 08 58.7	-12 11 25
15 U Ma	4.5	A3 _p	9 06 33.2	+51 44 20	ω Car	3.6	B8	10 12 57.4	-69 52 26
λ Vel	2.2	K5	9 06 46.8	-43 17 55	q Vel	4.1	A2	10 13 20.8	-41 57 29
τ U Ma	4.7	F5, A5	9 08 13.0	+63 38 57	ζ Leo	3.6	F0	10 14 51.5	+23 34 56
a Car	3.6	B3	9 10 05.9	-58 49 53	λ U Ma	3.5	A2	10 15 06.8	+43 04 47
i Car	4.2	B3	9 10 31.8	-62 10 53	187 G. Car	3.4	K5	10 15 58.7	-61 10 01
θ Hya	3.8	A0	9 12 38.9	+ 2 27 16	γ ¹ Leo	2.6	K0	10 18 09.3	+20 00 33
β Car	1.8	A0	9 12 50.8	-69 34 52	-54°3474	4.6	K0	10 18 22.2	-54 51 48
k Vel	4.7	F5	9 14 25.8	-37 16 30	J Vel	4.6	B5 _p	10 19 40.9	-55 52 36
g Car	4.2	K5	9 15 16.2	-57 24 10	μ U Ma	3.2	K5	10 20 22.2	+41 39 58
ι Car	2.2	F0	9 16 12.4	-59 08 11	I Car	4.1	F5	10 23 44.7	-73 51 48
38 Lyn	3.8	A2	9 16 47.8	+36 56 36	μ Hya	4.1	K5	10 24 29.6	-16 40 02
α Lyn	3.3	K5	9 19 03.0	+34 31 59	α Ant	4.4	K5	10 25 38.4	-30 53 57
κ Vel	2.6	B3	9 21 05.5	-54 52 09	β L Mi	4.4	K0	10 25 58.8	+36 52 37
κ Leo	4.6	K0	9 22 44.2	+26 19 31	s Car	4.1	F0	10 26 39.8	-58 34 14
α Hya	2.2	K2	9 25 57.9	- 8 30 53	p Car	3.6	B5 _p	10 30 50.8	-61 30 55
ε Ant	4.6	K2	9 27 52.9	-35 48 23	ρ Leo	3.8	B0 _p	10 31 04.5	+ 9 28 37

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
<i>r</i> Car	4.5	K5	10 34 19.0	-57 23 11	γ U Ma	2.5	A0	11 52 06.1	+53 52 41
γ Cha	4.1	M0	10 35 05.7	-78 26 11	π Vir	4.6	A3	11 59 10.9	+ 6 47 54
<i>p</i> Vel	4.1	F2, A3	10 35 54.6	-48 03 14	θ Cru	4.5	A5	12 01 20.0	-63 07 45
<i>t</i> Car	4.7	K5	10 37 29.4	-59 00 39	\circ Vir	4.2	G5	12 03 31.7	+ 8 54 58
<i>x</i> Vel	4.4	G0	10 37 59.3	-55 25 52	η Cru	4.3	F0	12 05 08.8	-64 25 47
θ Car	3.0	B0	10 41 46.5	-64 13 16	δ Cen	2.9	B3 p	12 06 38.4	-50 32 20
<i>w</i> Car	4.5	K5	10 42 16.5	-60 23 36	α Crv	4.2	F2	12 06 42.4	-24 32 42
μ Vel	2.8	G5	10 45 20.7	-49 14 44	ϵ Crv	3.2	K0	12 08 25.4	-22 26 11
δ^2 Cha	4.6	B3	10 45 29.9	-80 21 58	ρ Cen	4.2	B3	12 09 55.1	-52 11 06
ν Hya	3.3	K0	10 47 59.7	-16 01 14	δ Cru	3.1	B3	12 13 22.9	-58 33 56
46 L Mi	3.9	K0	10 51 28.3	+34 23 35	δ U Ma	3.4	A2	12 13 48.0	+57 12 57
<i>u</i> Car	3.9	K0	10 52 08.8	-58 40 40	γ Crv	2.8	B8	12 14 06.3	-17 21 32
54 Leo	4.5	A0	10 53 49.8	+24 55 34	ϵ Mus	4.2	M4	12 15 46.3	-67 46 38
<i>i</i> Ant	4.7	K0	10 55 10.6	-36 57 36	β Cha	4.4	B5	12 16 22.5	-79 07 45
α Crt	4.2	K0	10 58 09.9	-18 07 22	ζ Cru	4.3	B3	12 16 38.0	-63 49 12
239 G. Vel	4.6	A2	10 58 38.1	-42 02 55	η Vir	4.0	A0	12 18 13.0	- 0 29 01
β U Ma	2.4	A0	10 59 51.7	+56 33 35	ϵ Cru	3.6	K2	12 19 34.0	-60 13 09
60 Leo	4.4	A0	11 00 34.2	+20 21 25	α^1 Cru	1.0	B1	12 24 44.9	-62 54 59
α U Ma	1.9	K0	11 01 42.4	+61 55 46	γ Com	4.6	K0	12 25 17.7	+28 27 06
χ Leo	4.7	F0	11 03 18.9	+ 7 30 53	σ Cen	4.2	B3	12 26 14.8	-50 02 53
260 G. Car	4.0	F8 p	11 07 10.4	-58 47 46	δ Crv	3.1	A0	12 28 09.2	-16 19 55
ψ U Ma	3.1	K0	11 07 48.9	+44 40 40	γ Cru	1.6	M3	12 29 19.4	-56 55 43
β Crt	4.5	A2	11 10 01.9	-22 38 43	η Crv	4.4	F0	12 30 22.0	-16 00 49
<i>y</i> Car	4.7	F5 p	11 11 10.7	-60 08 16	γ Mus	4.0	B5	12 30 28.4	-71 57 03
δ Leo	2.6	A3	11 12 21.3	+20 42 17	κ Dra	3.9	B5 p	12 32 05.0	+69 58 11
θ Leo	3.4	A0	11 12 30.6	+15 36 36	β C Vn	4.3	G0	12 32 10.7	+41 32 11
ϕ Leo	4.6	A5	11 14 59.0	- 3 28 16	β Crv	2.8	G5	12 32 39.0	-23 12 52
ξ U Ma	3.9	G0	11 16 25.5	+31 42 54	α Mus	2.9	B3	12 35 11.8	-68 57 14
ν U Ma	3.7	K0	11 16 42.0	+33 16 28	τ Cen	4.0	A2	12 35 53.3	-48 21 36
δ Crt	3.8	K0	11 17 41.3	-14 35 59	γ Cen	2.4	A0	12 39 41.2	-48 46 44
σ Leo	4.1	A0	11 19 26.1	+ 6 12 37	γ Vir	2.9	F0	12 39 59.1	- 1 16 08
π Cen	4.3	B5	11 19 29.7	-54 18 36	<i>w</i> Cen	4.6	K0	12 40 45.2	-48 37 56
<i>i</i> Leo	4.0	F5	11 22 12.3	+10 42 40	ι Cru	4.7	K0	12 43 40.6	-60 48 02
γ Crt	4.1	A5	11 23 13.8	-17 30 09	β Mus	3.3	B3	12 44 14.3	-67 55 41
λ Dra	4.1	M0	11 29 27.9	+69 30 48	β Cru	1.5	B1	12 45 46.8	-59 30 31
ξ Hya	3.7	G5	11 31 22.5	-31 40 30	ϵ Cen	4.3	K2	12 51 14.2	-48 45 51
λ Cen	3.3	B9	11 34 15.0	-62 50 14	<i>n</i> Cen	4.3	A5	12 51 36.1	-39 59 59
ν Leo	4.5	K0	11 35 15.5	- 0 38 29	ϵ U Ma	1.7	A0 p	12 52 34.9	+56 08 19
λ Mus	3.8	A5	11 44 02.3	-66 32 45	μ Cru	4.3	B3	12 52 38.5	-56 59 57
ν Vir	4.2	M0	11 44 09.8	+ 6 42 52	δ Vir	3.7	M0	12 53 56.4	+ 3 34 35
χ U Ma	3.8	K0	11 44 18.8	+47 57 44	α^2 C Vn	2.9	A0 p	12 54 29.2	+38 29 46
65 G. Cen	4.2	G0	11 44 54.4	-60 59 42	δ Mus	3.6	K2	12 59 58.4	-71 22 17
93 Leo	4.5	F8	11 46 17.1	+20 24 08	ϵ Vir	2.9	K0	13 00 32.0	+11 08 10
μ Mus	4.7	K5	11 46 38.5	-66 37 53	ξ^2 Cen	4.4	B3	13 04 58.4	-49 43 48
β Leo	2.2	A2	11 47 22.6	+14 45 23	θ Vir	4.5	A0	13 08 14.3	- 5 21 48
<i>j</i> Cen	4.5	B5	11 48 04.0	-63 36 18	α Com	4.5	F5	13 08 22.9	+17 42 12
β Vir	3.8	F8	11 48 58.5	+ 1 57 02	β Com	4.3	G0	13 10 20.0	+28 02 42
B Cen	4.7	K0	11 49 29.2	-44 59 23	20 C Vn	4.7	F0	13 16 03.9	+40 44 45
β Hya	4.4	B9	11 51 14.2	-33 43 28	γ Hya	3.3	G5	13 17 07.4	-22 59 53

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
<i>i</i> Cen	2.9	A2	13 18 44.1	-36 32 20	σ Lup	4.6	B2	14 30 22.8	-50 18 43
<i>J</i> Cen	4.6	B5	13 20 29.0	-60 48 57	γ Boo	3.0	F0	14 30 44.9	+38 27 06
<i>m</i> Cen	4.5	G0	13 21 46.3	-64 21 50	σ Boo	4.5	F0	14 33 14.6	+29 53 15
ζ U Ma	2.4	A2 _p	13 22 36.0	+55 05 50	η Cen	2.6	B3 _p , A2 _p	14 33 24.2	-42 00 50
α Vir	1.2	B2	13 23 27.1	-10 59 23	ρ Lup	4.1	B5	14 35 39.3	-49 16 59
80 U Ma	4.0	A5	13 23 54.4	+55 09 34	α Cen	0.1	G0	14 37 20.7	-60 42 01
<i>R</i> Hya	3-10	M7 _e	13 27 54.3	-23 06 41	ζ Boo	3.9	A2	14 39 34.3	+13 52 08
<i>d</i> Cen	4.0	K0	13 29 07.4	-39 14 15	α Lup	2.9	B2	14 39 43.5	-47 14 52
ζ Vir	3.4	A2	13 33 00.6	- 0 25 40	α Cir	3.4	F0	14 39 49.1	-64 49 59
24 C Vn	4.6	A3	13 33 06.5	+49 11 03	<i>b</i> Cen	4.1	B3	14 39 54.1	-37 39 11
ϵ Cen	2.6	B1	13 37 47.1	-53 17 57	μ Vir	3.9	F5	14 41 19.1	- 5 30 57
83 U Ma	4.7	M2	13 39 29.3	+54 50 53	371 G. Cen	4.1	K0	14 41 37.9	-35 01 58
1 Cen	4.4	F5	13 43 48.3	-32 52 39	ϵ Boo	2.7	K0	14 43 32.7	+27 12 45
<i>M</i> Cen	4.7	K0	13 44 33.3	-51 16 05	\circ Boo	4.7	K0	14 43 42.0	+17 06 11
τ Boo	4.5	F5	13 45 41.6	+17 37 14	α Aps	3.8	K5	14 43 40.6	-78 54 25
η U Ma	1.9	B3	13 46 14.5	+49 28 39	109 Vir	3.8	A0	14 44 34.7	+ 2 01 51
ν Cen	3.5	B2	13 47 31.0	-41 31 26	58 Hya	4.6	K2	14 48 20.7	-27 49 27
2 Cen	4.4	M6	13 47 31.6	-34 17 12	α^2 Lib	2.9	A3	14 49 02.9	-15 54 21
μ Cen	3.3	B2 _p	13 47 37.2	-42 18 36	\circ Lup	4.5	B5	14 49 28.6	-43 26 24
ν Boo	4.3	K5	13 47 53.1	+15 57 39	ξ Boo	4.6	G5	14 49 51.9	+19 14 13
3 Cen	4.7	B5	13 49 54.9	-32 49 53	β U Mi	2.2	K5	14 50 46.9	+74 17 25
η Boo	2.8	G0	13 53 06.8	+18 33 45	16 Lib	4.6	F0	14 55 27.4	- 4 12 47
ζ Cen	3.1	B2 _p	13 53 28.2	-47 07 36	β Lup	2.8	B2 _p	14 56 21.6	-43 00 08
294 G. Cen	4.7	K0	13 55 14.4	-63 31 34	κ Cen	3.3	B3	14 57 00.4	-41 58 23
ϕ Cen	4.0	B3	13 56 15.4	-41 56 25	β Boo	3.6	G5	15 00 42.1	+40 31 11
ν^1 Cen	4.2	B3	13 56 37.9	-44 38 36	110 Vir	4.6	K0	15 01 13.8	+ 2 13 11
ν^2 Cen	4.4	F5	13 59 39.3	-45 26 40	σ Lib	3.4	M3	15 02 08.0	-25 09 13
τ Vir	4.3	A2	13 59 57.9	+ 1 42 12	π Lup	4.0	B5	15 02 51.7	-46 55 24
β Cen	0.9	B1	14 01 28.7	-60 12 53	ψ Boo	4.7	K0	15 03 01.8	+27 04 31
α Dra	3.6	A0 _p	14 03 29.7	+64 31 59	λ Lup	4.4	B3	15 06 36.6	-45 09 15
χ Cen	4.5	B3	14 04 01.4	-41 01 21	κ^1 Lup	4.1	B9	15 09 37.8	-48 36 50
π Hya	3.5	K0	14 04 29.2	-26 31 27	ζ Lup	3.5	K0	15 09 54.1	-51 58 30
θ Cen	2.3	K0	14 04 44.0	-36 12 30	ι Lib	4.7	A0 _p	15 10 20.1	-19 40 05
κ Vir	4.3	K0	14 11 07.9	-10 07 16	δ Boo	3.5	K0	15 14 10.3	+33 26 13
κ Boo	4.6	A5	14 12 18.1	+51 56 37	β Cir	4.2	A3	15 14 54.9	-58 40 47
α Boo	0.2	K0	14 14 09.3	+19 21 12	β Lib	2.7	B8	15 15 13.7	- 9 15 45
ι Vir	4.2	F5	14 14 16.9	- 5 50 38	2 Lup	4.4	K0	15 15 49.0	-30 01 43
λ Boo	4.3	A0	14 15 07.8	+46 14 21	γ Tr A	3.1	A0	15 15 48.1	-68 33 34
ι Lup	4.1	B3	14 17 16.8	-45 54 24	μ Lup	4.4	B8	15 16 13.6	-47 45 18
λ Vir	4.6	A2	14 17 19.2	-13 13 12	δ Lup	3.4	B2	15 19 11.9	-40 31 46
ν Cen	4.4	B5	14 18 00.3	-56 14 08	ϕ^1 Lup	3.6	K5	15 19 42.3	-36 08 35
ψ Cen	4.2	A0	14 18 32.5	-37 44 04	ϵ Lup	3.7	B3	15 20 25.8	-44 34 20
α Cen	4.5	B5	14 20 59.7	-39 21 44	γ U Mi	3.1	A2	15 20 45.9	+71 57 05
δ Oct	4.1	K2	14 21 24.7	-83 31 09	γ Cir	4.5	B5, F8	15 20 44.0	-59 12 13
θ Boo	4.1	F8	14 24 04.4	+52 00 09	ϕ^2 Lup	4.7	B3	15 21 02.4	-36 44 30
τ^1 Lup	4.6	B3	14 24 00.5	-45 04 24	μ^1 Boo	4.5	F0	15 23 14.5	+37 29 31
τ^2 Lup	4.5	F8	14 24 02.9	-45 13 53	<i>k</i> Lup	4.7	A0	15 23 11.3	-38 37 05
5 U Mi	4.4	K2	14 27 34.3	+75 50 33	ι Dra	3.5	K0	15 24 11.5	+59 04 52
ρ Boo	3.8	K0	14 30 24.4	+30 30 56	β Cr B	3.7	F0 _p	15 26 28.0	+29 13 06

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
θ Cr B	4.2	B5	15 31 35.8	+31 28 10	σ Sco	3.1	B1	16 19 10.7	-25 30 55
γ Lup	2.9	B3	15 32 56.0	-41 03 26	γ Her	3.8	F0	16 20 27.8	+19 13 46
δ Ser	4.2	F0	15 33 13.4	+10 38 53	ξ Cr B	4.7	K0	16 20 48.6	+30 58 03
α Cr B	2.3	A0	15 33 17.4	+26 49 29	ψ Oph	4.6	K0	16 22 10.1	-19 57 42
γ Lib	4.0	K0	15 33 40.6	-14 40 51	η Dra	2.9	G5	16 23 32.4	+61 35 19
ϵ Tr A	4.1	K0	15 33 40.7	-66 12 30	ω Her	4.5	A0p	16 23 53.4	+14 06 29
ν Lib	3.8	K2	15 35 00.9	-28 01 38	ν Oph	4.7	A2	16 26 00.9	- 8 17 58
ω Lup	4.3	K5	15 35 49.3	-42 27 38	α Sco	1.2	M0,A3	16 27 22.8	-26 21 38
τ Lib	3.8	B3	15 36 37.4	-29 40 15	γ Aps	3.9	K0	16 28 19.8	-78 49 36
ψ Lup	4.6	K0	15 37 39.9	-34 18 20	β Her	2.8	K0	16 28 48.0	+21 33 37
g Lup	4.7	F5	15 38 54.7	-44 33 12	λ Oph	3.8	A0	16 29 14.9	+ 2 03 17
ι Ser	4.5	A2	15 40 04.7	+19 46 32	N Sco	4.3	B3	16 29 13.3	-34 38 03
γ Cr B	3.9	A0	15 41 21.3	+26 23 56	ϕ Oph	4.4	K0	16 29 14.8	-16 32 32
α Ser	2.7	K0	15 42 38.4	+ 6 31 41	ω Oph	4.6	F0	16 30 10.5	-21 23 51
β Ser	3.7	A2	15 44 39.8	+15 31 26	σ Her	4.2	A0	16 33 02.2	+42 30 15
λ Ser	4.4	G0	15 44 50.4	+ 7 27 19	τ Sco	2.9	B0	16 33 49.4	-28 08 57
ζ U Mi	4.3	A2	15 45 11.9	+77 53 48	H Sco	4.3	M2	16 34 11.9	-35 11 22
κ Ser	4.3	K5	15 47 15.2	+18 14 32	ζ Oph	2.7	B0	16 35 20.3	-10 30 06
μ Ser	3.6	A0	15 47 53.7	- 3 19 50	β Aps	4.2	K0	16 38 19.2	-77 27 07
δ Cr B	4.7	G5	15 48 12.5	+26 10 05	ζ Her	3.0	G0	16 40 02.5	+31 39 41
χ Lup	4.1	B9	15 48 51.3	-33 31 41	η Her	3.6	K0	16 41 45.8	+38 59 02
ϵ Ser	3.7	A2	15 49 10.1	+ 4 34 33	α Tr A	1.9	K2	16 45 09.2	-68 58 11
χ Her	4.6	G0	15 51 32.0	+42 32 35	η Ara	3.7	K5	16 46 55.6	-58 59 05
2 Sco	4.7	B3	15 51 37.5	-25 13 48	20 Oph	4.7	F5	16 48 00.3	-10 43 34
θ Lib	4.3	K0	15 51 56.5	-16 38 02	ϵ Sco	2.4	K0	16 48 01.3	-34 14 06
β Tr A	3.0	F0	15 52 13.0	-63 19 51	ϵ U Mi	4.4	G5	16 49 17.0	+82 05 39
ρ Sco	4.0	B3	15 54 50.5	-29 07 09	μ^1 Sco	3.1	B3p	16 49 37.8	-37 59 33
γ Ser	3.9	F5	15 54 55.6	+15 46 05	μ^2 Sco	3.6	B2	16 50 05.7	-37 57 47
ϵ Cr B	4.2	K0	15 56 13.2	+26 58 20	ζ Sco	3.7	K5	16 52 15.4	-42 18 24
48 Lib	4.7	B3p	15 56 20.2	-14 11 08	ι Oph	4.3	B8	16 52 26.7	+10 13 06
π Sco	3.0	B2	15 56 51.0	-26 01 14	ζ Ara	3.1	K5	16 55 52.9	-55 56 24
η Lup	3.6	B3	15 57 55.7	-38 18 14	κ Oph	3.4	K0	16 56 06.3	+ 9 25 30
δ Sco	2.5	B0	15 58 22.7	-22 31 45	ϵ Ara	4.1	K2	16 56 56.8	-53 06 43
η Nor	4.7	G5	16 00 46.7	-49 08 22	ϵ Her	3.9	A0	16 59 01.5	+30 58 26
θ Dra	4.1	F8	16 01 16.0	+58 39 10	η Oph	2.6	A2	17 08 29.0	-15 41 08
ν Her	4.6	B9	16 01 46.1	+46 07 39	ζ Dra	3.2	B5	17 08 41.2	+65 45 18
ξ Sco	4.2	F8	16 02 33.0	-11 17 01	η Sco	3.4	F2	17 09 47.1	-43 11 51
β^1 Sco	2.9	B1	16 03 30.8	-19 43 00	α Her	3.5	M3	17 13 08.5	+14 25 36
θ Lup	4.3	B3	16 04 25.1	-36 42 51	δ Her	3.2	A2	17 13 40.5	+24 52 37
ω^1 Sco	4.1	B2	16 04 52.4	-20 34 53	π Her	3.4	K5	17 13 53.8	+36 50 43
ω^2 Sco	4.6	G0	16 05 27.9	-20 46 52	68 Her	4-5	B3	17 16 06.3	+33 08 04
ϕ Her	4.3	B9p	16 07 43.7	+45 01 14	ζ Aps	4.7	K2	17 18 31.9	-67 44 19
ν Sco	4.3	B3	16 10 04.4	-19 22 35	ν Ser	4.3	A0	17 18 58.1	-12 48 54
13 Sco	4.7	B3	16 10 15.9	-27 50 33	ξ Oph	4.5	F5	17 19 01.4	-21 04 45
δ Tr A	4.0	G0	16 12 25.1	-63 36 13	θ Oph	3.4	B3	17 19 58.8	-24 58 06
δ Oph	3.0	M0	16 12 36.8	- 3 36 39	ρ Her	4.5	A0	17 22 32.6	+37 10 31
ϵ Oph	3.3	K0	16 16 34.3	- 4 36 49	β Ara	2.8	K2	17 22 33.0	-55 30 04
γ^2 Nor	4.1	K0	16 17 21.7	-50 04 35	γ Ara	3.5	B1	17 22 36.6	-56 20 56
τ Her	3.9	B5	16 18 44.8	+46 23 28	44 Oph	4.3	F0	17 24 21.1	-24 08 48

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
σ Oph	4.4	K0	17 24 52.5	+ 4 10 03	-27°12684	4.7	K5	18 15 59.2	-27 03 22
27 H. Oph	4.6	F0	17 24 52.7	- 5 03 32	κ Lyr	4.3	K0	18 18 42.2	+36 02 55
45 Oph	4.4	F5	17 25 14.7	-29 50 21	δ Sgr	2.8	K0	18 18 52.8	-29 50 38
δ Ara	3.8	B8	17 28 06.8	-60 39 31	η Ser	3.4	K0	18 19 36.0	- 2 54 32
ν Sco	2.8	B3	17 28 31.0	-37 16 17	ξ Pav	4.2	K2	18 20 11.1	-61 30 41
α Ara	3.0	B3p	17 29 17.2	-49 51 08	ϕ Dra	4.2	A0p	18 21 13.9	+71 19 14
λ Her	4.5	K0	17 29 24.2	+26 08 04	χ Dra	3.7	F8	18 21 39.1	+72 43 08
β Dra	3.0	G0	17 29 41.1	+52 19 30	ϵ Sgr	1.9	A0	18 21 58.8	-34 24 08
λ Sco	1.7	B2	17 31 21.9	-37 04 54	109 Her	3.9	K0	18 22 17.4	+21 45 12
σ Ara	4.6	A0	17 33 11.9	-46 29 06	α Tel	3.8	B3	18 24 31.6	-45 59 19
α Oph	2.1	A5	17 33 24.1	+12 34 58	λ Sgr	2.9	K0	18 25 56.0	-25 26 30
Q Sco	4.3	K0	17 34 16.3	-38 36 50	γ Tel	4.1	K0	18 26 17.3	-49 05 27
θ Sco	2.0	F0	17 34 56.6	-42 58 44	ζ Sct	4.7	A3	18 27 18.9	-14 35 18
ξ Ser	3.6	A5	17 35 41.7	-15 22 46	θ Cr A	4.7	G5	18 31 08.7	-42 20 17
μ Oph	4.6	B8	17 36 02.9	- 8 06 01	α Sct	4.1	K0	18 33 24.6	- 8 16 07
ι Her	3.8	B3	17 38 31.9	+46 01 23	α Lyr	0.1	A0	18 35 49.2	+38 45 07
\circ Ser	4.4	A2	17 39 33.5	-12 51 33	ζ Pav	4.1	K0	18 39 11.3	-71 27 34
κ Sco	2.5	B2	17 40 12.1	-39 00 54	δ Sct	4.7	F0	18 40 28.0	- 9 05 08
δ U Mi	4.4	A0	17 42 48.5	+86 36 14	ϵ Lyr	4.5	A5	18 43 17.1	+39 34 38
β Oph	2.9	K0	17 41 50.4	+ 4 34 46	ζ Lyr	4.3	A3	18 43 38.1	+37 34 10
η Pav	3.6	K0	17 42 29.4	-64 42 38	ϕ Sgr	3.3	B8	18 43 35.7	-27 01 35
μ Her	3.5	G5	17 45 09.9	+27 44 20	110 Her	4.3	F5	18 44 14.4	+20 30 49
ι Sco	3.1	F5p	17 45 16.4	-40 06 58	β Sct	4.5	G0	18 45 25.3	- 4 47 05
X Sgr	4-5	F5-G0	17 45 28.9	-27 49 12	111 Her	4.4	A3	18 45 33.7	+18 08 36
γ Oph	3.7	A0	17 46 14.2	+ 2 43 06	R Sct	4-9	K0p	18 45 43.2	- 5 44 31
G Sco	3.2	K2	17 47 36.6	-37 02 05	β^1 Lyr	3-4	B8p, B2p	18 48 51.6	+33 19 24
ξ Dra	3.9	K0	17 52 57.4	+56 52 38	λ Pav	4.4	B2	18 49 09.8	-62 13 41
θ Her	4.0	K0	17 55 07.2	+37 15 14	σ Sgr	2.1	B3	18 53 13.1	-26 20 22
γ Dra	2.4	K5	17 55 50.3	+51 29 31	δ Lyr	4.5	M4	18 53 20.9	+36 51 21
ξ Her	3.8	K0	17 56 28.9	+29 15 01	113 Her	4.6	G0, A3	18 53 21.2	+22 36 08
ν Her	4.5	F0	17 57 14.3	+30 11 27	κ Pav	4-5	F5p	18 53 33.3	-67 16 39
ν Oph	3.5	K0	17 57 12.5	- 9 46 16	R Lyr	4-5	M3	18 54 19.8	+43 54 06
93 Her	4.7	K0	17 58 35.2	+16 45 06	θ^1 Ser	4.5	A5	18 54 34.7	+ 4 09 33
ζ Ser	4.6	F0	17 58 44.3	- 3 41 23	ξ^2 Sgr	3.6	K0	18 55 45.6	-21 09 06
67 Oph	3.9	B5p	17 58 59.4	+ 2 55 54	γ Lyr	3.3	A0p	18 57 42.5	+32 38 35
68 Oph	4.4	A2	18 00 04.6	+ 1 18 16	ϵ Aql	4.2	K0	18 58 07.4	+15 01 20
W Sgr	4-5	F8p	18 02 54.7	-29 35 00	12 Aql	4.1	K0	18 59 55.0	- 5 47 13
γ Sgr	3.1	K0	18 03 41.2	-30 25 35	ζ Sgr	2.7	A2	19 00 30.7	-29 55 45
70 Oph	4.1	K0	18 03 47.2	+ 2 30 21	σ Sgr	3.9	K0	19 02 42.3	-21 47 29
θ Ara	3.9	B1p	18 04 03.6	-50 05 45	ζ Aql	3.0	A0	19 03 53.5	+13 48 47
π Pav	4.4	A5	18 05 24.1	-63 40 20	γ Cr A	4.3	F8	19 04 11.3	-37 06 45
71 Oph	4.7	G5	18 05 43.6	+ 8 43 42	λ Aql	3.5	B9	19 04 29.8	- 4 56 00
72 Oph	3.7	A3	18 05 47.0	+ 9 33 28	τ Sgr	3.4	K0	19 04 52.8	-27 43 13
-28°14174	4.7	K0	18 05 59.5	-28 27 45	δ Cr A	4.7	K0	19 06 03.1	-40 32 59
\circ Her	3.8	A0	18 06 15.2	+28 45 25	α Cr A	4.1	A2	19 07 13.7	-37 57 28
102 Her	4.3	B3	18 07 20.7	+20 48 29	β Cr A	4.2	G5	19 07 45.6	-39 23 42
ϵ Tel	4.6	K0	18 08 46.7	-45 57 44	π Sgr	3.0	F2	19 07 48.1	-21 04 40
μ Sgr	4.0	B8p	18 11 47.3	-21 04 09	δ Dra	3.2	K0	19 12 33.1	+67 36 12
η Sgr	3.2	M3	18 15 23.5	-36 46 24	η Lyr	4.5	B3	19 12 38.0	+39 05 18

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Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
1 Vul	4.6	B5	19 14 47.8	+21 19 51	39 Cyg	4.6	K2	20 22 32.4	+32 04 58
θ Lyr	4.5	K0	19 15 13.3	+38 04 26	α Pav	2.1	B3	20 23 02.8	-56 50 33
τ Dra	4.6	K0	19 16 11.8	+73 17 41	41 Cyg	4.1	F5 _p	20 28 02.7	+30 15 27
κ Cyg	4.0	K0	19 16 20.4	+53 18 25	θ Cep	4.3	A5	20 29 01.8	+62 52 58
ρ Sgr	3.9	A5	19 19 45.5	-17 54 39	ε Del	4.0	B5	20 31 38.1	+11 11 24
ν Sgr	4.6	B8 _p , F2 _p	19 19 50.2	-16 01 06	ζ Del	4.7	A2	20 33 45.9	+14 33 34
β ¹ Sgr	4.3	B8	19 20 16.1	-44 31 22	α Ind	3.2	K0	20 35 15.1	-47 24 29
π Dra	4.6	A2	19 20 30.1	+65 39 03	β Del	3.7	F5	20 36 00.0	+14 28 45
β ² Sgr	4.5	F0	19 20 50.2	-44 51 49	71 Aql	4.5	K0	20 36 38.0	- 1 13 18
α Sgr	4.1	B8	19 21 36.1	-40 40 47	α Del	3.9	B8	20 38 06.2	+15 47 40
δ Aql	3.4	F0	19 23 50.0	+ 3 02 51	α Cyg	1.3	A2 _p	20 40 18.3	+45 09 42
α Vul	4.6	M0	19 27 19.9	+24 35 49	η Ind	4.7	F0	20 41 37.4	-52 02 26
ι Cyg	3.9	A2	19 28 52.4	+51 39 31	δ Del	4.5	A5	20 41 55.0	+14 57 18
β ¹ Cyg	3.2	K0, A0	19 29 23.3	+27 53 21	β Pav	3.6	A5	20 42 00.3	-66 19 25
μ Aql	4.6	K0	19 32 28.6	+ 7 18 27	ψ Cap	4.3	F8	20 44 08.6	-25 23 27
52 Sgr	4.7	B9	19 34 42.0	-24 57 29	52 Cyg	4.3	K0	20 44 17.9	+30 35 54
ι Aql	4.3	B5	19 35 00.8	- 1 21 40	6 H. Cep	4.6	G0	20 44 32.0	+57 27 39
θ Cyg	4.6	F5	19 35 33.3	+50 08 38	η Cep	3.6	K0	20 44 37.2	+61 42 37
α Sge	4.4	G0	19 38 37.2	+17 56 12	ε Cyg	2.6	K0	20 44 52.5	+33 50 45
β Sge	4.4	K0	19 39 33.9	+17 23 54	γ ² Del	4.5	G5	20 45 07.5	+16 00 16
δ Cyg	3.0	A0	19 43 56.5	+45 02 57	ε Aqr	3.8	A0	20 45 53.4	- 9 37 04
γ Aql	2.8	K2	19 44 41.4	+10 31 54	3 Aqr	4.6	M0	20 45 59.7	- 5 08 59
δ Sge	3.8	M0, A0	19 45 54.9	+18 27 06	λ Cyg	4.5	B5	20 46 07.3	+36 22 07
ε Dra	4.0	K0	19 48 17.5	+70 11 02	ω Cap	4.2	M0	20 49 51.3	-27 02 38
α Aql	0.9	A5	19 49 10.3	+ 8 46 48	57 Cyg	4.7	B3	20 52 04.6	+44 15 42
χ Cyg	4-14	M7 _e	19 49 17.7	+32 49 47	β Ind	3.7	K0	20 52 14.6	-58 34 49
η Aql	3-4	G0 _p	19 50 47.5	+ 0 55 11	ν Cyg	4.0	A0	20 55 56.4	+41 02 22
13 Vul	4.5	A0	19 52 03.4	+23 59 33	γ Mic	4.7	G5	20 59 16.3	-32 23 17
ι Sgr	4.2	K0	19 52 59.3	-41 57 24	ξ Cyg	3.9	K5	21 03 43.7	+43 47 44
β Aql	3.9	K0	19 53 41.5	+ 6 19 23	θ Cap	4.2	A0	21 04 05.6	-17 21 54
59 Sgr	4.6	K2	19 54 55.4	-27 15 32	A Cap	4.6	M0	21 05 12.0	-25 08 20
η Cyg	4.0	K0	19 55 04.0	+34 59 41	ν Aqr	4.5	K0	21 07 47.8	-11 30 23
ε Pav	4.1	A0	19 56 48.3	-73 00 01	ζ Cyg	3.4	K0	21 11 31.8	+30 05 27
γ Sge	3.7	K5	19 57 17.3	+19 24 05	δ Equ	4.6	F5	21 12 52.3	+ 9 52 20
θ ¹ Sgr	4.4	B3	19 57 35.5	-35 22 02	τ Cyg	3.8	F0	21 13 28.3	+37 54 14
15 Vul	4.7	A5	19 59 44.4	+27 39 41	α Equ	4.1	F8, A3	21 14 10.4	+ 5 06 38
62 Sgr	4.6	M3	20 00 37.8	-27 48 11	σ Cyg	4.3	A0 _p	21 16 07.0	+39 15 20
ρ Dra	4.7	K0	20 02 40.5	+67 46 46	ν Cyg	4.4	B3 _p	21 16 33.5	+34 45 27
δ Pav	3.6	G5	20 05 30.2	-66 16 07	θ Ind	4.6	A5	21 17 31.4	-53 35 21
θ Aql	3.4	A0	20 09 36.1	- 0 55 14	α Cep	2.6	A5	21 17 47.5	+62 26 43
κ Cep	4.4	B9	20 10 01.9	+77 36 46	ι Cap	4.3	K0	21 20 24.6	-16 58 34
α ² Cyg	3.9	K0, B8	20 12 35.5	+46 38 26	1 Peg	4.3	K0	21 20 33.5	+19 39 45
33 Cyg	4.3	A3	20 12 37.8	+56 27 58	γ Pav	4.3	F8	21 23 44.2	-65 31 01
23 Vul	4.7	K5	20 14 24.0	+27 42 43	ζ Cap	3.9	G5 _p	21 24 47.1	-22 33 19
32 Cyg	4.2	K0, A3	20 14 27.0	+47 36 44	36 Cap	4.6	G5	21 26 50.6	-21 57 07
α ¹ Cap	4.5	G0 _p	20 15 49.1	-12 36 41	β Cep	3.3	B1	21 28 14.4	+70 24 56
α ² Cap	3.8	G5	20 16 13.4	-12 38 54	β Aqr	3.1	G0	21 29 49.3	- 5 43 02
β Cap	3.2	G0, A0	20 19 09.5	-14 53 13	ρ Cyg	4.2	K0	21 32 44.2	+45 26 43
γ Cyg	2.3	F8 _p	20 21 02.5	+40 09 01	ε Cap	4.7	B5 _p	21 35 14.1	-19 36 53

FOR JANUARY 1st.041

Name	Mag.	Sp.	Right Ascension	Declination	Name	Mag.	Sp.	Right Ascension	Declination
			h m s	° ' "				h m s	° ' "
ν Oct	3.7	K0	21 37 52.6	-77 32 17	β Oct	4.3	F0	22 42 47.8	-81 33 20
γ Cap	3.8	F0 _p	21 38 15.8	-16 48 44	λ Peg	4.1	K0	22 44 56.3	+23 23 29
μ Cep	4-5	M2	21 42 29.7	+58 37 41	ξ Peg	4.3	F5	22 45 02.5	+12 00 11
ϵ Peg	2.5	K0	21 42 33.8	+ 9 43 22	ϵ Gru	3.7	A2	22 46 34.2	-51 29 27
μ Cyg	4.7	F5	21 42 39.9	+28 35 35	τ Aqr	4.2	K5	22 47 50.7	-13 46 02
9 Peg	4.5	G5	21 42 56.8	+17 11 52	μ Peg	3.7	K0	22 48 24.4	+24 25 37
ι Ps A	4.3	A0	21 42 59.1	-33 10 39	ι Cep	3.7	K0	22 48 30.0	+66 01 36
κ Peg	4.3	F5	21 43 08.9	+25 29 33	γ Ps A	4.5	A0	22 50 41.7	-33 03 04
ν Cep	4.5	A2 _p	21 44 29.7	+60 58 05	λ Aqr	3.8	M0	22 50 53.5	- 7 45 20
δ Cap	3.0	A5	21 45 13.2	-16 16 40	δ Aqr	3.5	A2	22 52 54.0	-15 59 48
π^2 Cyg	4.3	B3	21 45 34.3	+49 09 23	δ Ps A	4.3	K0	22 54 07.4	-32 42 59
γ Gru	3.2	B8	21 51 56.1	-37 31 15	α Ps A	1.3	A3	22 55 49.8	-29 47 51
δ Ind	4.6	F0	21 55 41.0	-55 09 02	ζ Gru	4.2	G5	22 58 56.4	-52 55 54
ϵ Ind	4.7	K5	22 00 50.9	-56 55 22	\circ And	3.6	B5, A2 _p	23 00 23.9	+42 08 54
\circ Aqr	4.7	B5 _p	22 01 36.4	- 2 18 56	β Peg	2.6	M0	23 02 10.2	+27 54 12
ξ Cep	4.6	A3	22 02 50.0	+64 28 00	β Psc	4.6	B5 _p	23 02 11.7	+ 3 38 31
α Aqr	3.2	G0	22 04 05.3	- 0 28 51	α Peg	2.6	A0	23 03 06.9	+15 01 38
λ Gru	4.6	K2	22 04 07.9	-39 42 12	θ Gru	4.3	F5	23 05 01.5	-43 41 57
ι Aqr	4.3	B8	22 04 39.3	-14 01 50	55 Peg	4.7	M0	23 05 20.4	+ 9 13 51
ι Peg	4.0	F5	22 05 28.3	+25 11 00	π Cep	4.6	G5	23 06 50.5	+75 12 32
α Gru	2.2	B5	22 06 09.6	-47 07 18	88 Aqr	3.8	K0	23 07 41.3	-21 21 07
μ Ps A	4.6	A2	22 06 27.7	-33 09 02	ι Gru	4.1	K0	23 08 29.8	-45 25 33
π Peg	4.4	F5	22 08 31.1	+33 00 56	7 And	4.6	F0	23 11 01.9	+49 13 33
θ Peg	3.7	A2	22 08 32.0	+ 6 02 05	ϕ Aqr	4.4	M0	23 12 36.8	- 6 13 38
ζ Cep	3.6	K0	22 09 42.4	+58 02 17	ψ^1 Aqr	4.5	K0	23 14 09.8	- 9 16 04
1 H. Lac	4.6	K2	22 12 27.5	+39 33 02	γ Psc	3.8	K0	23 15 27.2	+ 3 06 06
ϵ Cep	4.2	F0	22 13 49.0	+56 52 43	γ Tuc	4.1	F2	23 15 30.8	-58 25 01
1 Lac	4.2	K0	22 14 31.7	+37 35 02	93 Aqr	4.6	B5	23 16 11.3	- 9 21 47
θ Aqr	4.3	K0	22 15 05.5	- 7 56 54	γ Scl	4.5	K0	23 17 02.7	-32 42 43
α Tuc	2.9	K2	22 16 15.3	-60 25 30	τ Peg	4.6	A5	23 19 00.0	+23 33 34
2 Lac	4.7	B5	22 19 39.5	+46 22 12	98 Aqr	4.2	K0	23 21 14.3	-20 16 51
γ Aqr	4.0	A0	22 19 57.1	- 1 33 15	ν Peg	4.6	G0	23 23 43.7	+23 13 20
β Lac	4.6	K0	22 22 15.5	+52 03 48	99 Aqr	4.5	K5	23 24 18.8	-20 49 23
4 Lac	4.6	B8 _p	22 23 10.4	+49 18 31	θ Psc	4.4	G5	23 26 17.5	+ 6 11 51
π Aqr	4.6	B1 _p	22 23 35.4	+ 1 12 34	70 Peg	4.7	K0	23 27 29.0	+12 34 42
ζ Aqr	4.4	F2	22 27 08.0	- 0 11 23	β Scl	4.5	B9	23 31 12.3	-38 00 04
δ^1 Gru	4.0	G5	22 27 18.2	-43 39 54	λ And	4.0	K0	23 35 56.5	+46 16 45
δ^2 Gru	4.3	M4	22 27 47.5	-43 55 08	ι And	4.3	B8	23 36 30.7	+43 05 07
δ Cep	3-4	F5-G0	22 27 56.4	+58 14 45	γ Cep	3.4	K0	23 37 58.6	+77 26 53
5 Lac	4.6	K0, A0	22 28 09.1	+47 32 15	ι Psc	4.3	F8	23 38 15.1	+ 5 26 50
6 Lac	4.5	B3	22 29 03.5	+42 57 14	κ And	4.3	A0	23 38 46.5	+44 09 04
β Ps A	4.4	A0	22 29 38.0	-32 30 57	λ Psc	4.6	A5	23 40 21.7	+ 1 35 54
α Lac	3.8	A0	22 29 55.6	+50 06 45	ω^2 Aqr	4.6	A0	23 41 00.7	-14 43 39
η Aqr	4.1	B8	22 33 39.6	- 0 17 17	δ Scl	4.6	A0	23 47 12.5	-28 18 46
ϵ Ps A	4.2	B8	22 38 50.0	-27 12 59	ρ Cas	4-5	F8 _p	23 52 43.5	+57 18 57
11 Lac	4.6	K0	22 39 03.7	+44 06 13	ψ Peg	4.7	M0	23 56 04.4	+24 57 29
ζ Peg	3.6	B8	22 39 48.9	+10 39 31	ω Psc	4.0	F5	23 57 36.9	+ 6 40 50
β Gru	2.2	M3	22 40 42.2	-47 03 28	ϵ Tuc	4.7	B9	23 58 12.8	-65 45 39
η Peg	3.1	G0	22 41 27.1	+30 02 53	θ Oct	4.7	K0	23 59 55.4	-77 14 52

There are four eclipses, two of the Sun and two of the Moon.

I	April 24	Total eclipse of the Moon
II	May 9	Partial eclipse of the Sun
III	October 18	Total eclipse of the Moon
IV	November 2	Total eclipse of the Sun

A correction of $-0''.6$ has been applied to the tabular latitude of the Moon. This correction is given below in the form of corrections to the right ascension and declination of the Moon.

	d	$\Delta\alpha$ s	$\Delta\delta$ "
April	24	- 0.014	- 0.56
May	9	+ 0.012	- 0.58
October	18	+ 0.015	- 0.56
November	2	- 0.013	- 0.57

The arguments are given in Ephemeris Time. The hour angle μ and the longitudes are referred to the ephemeris meridian. East longitudes are negative. Once the value of ΔT is known, the data on these pages may be expressed in terms of Universal Time in the following manner:

Convert all arguments into Universal Time by the relation $U.T. = E.T. - \Delta T$.

Apply the correction $-1.0027 \Delta T$ to μ and to the longitudes, in order to refer them to the meridian of Greenwich, remembering that a second of time is equivalent to 15 seconds of arc.

Leave all other quantities unchanged.

I.—*Total Eclipse of the Moon*, April 24; the beginning of the penumbral phase visible in North America except the northeast part, the western part of South America, the Pacific Ocean, the east coast of Asia, Australia, New Zealand, and Antarctica; the end visible in the Pacific Ocean except the southeastern part, the eastern part of Asia, the eastern part of the Indian Ocean, Indonesia, Australia, New Zealand, and Antarctica.

ELEMENTS OF THE ECLIPSE

E.T. of geocentric opposition in right ascension, April 24^d 11^h 52^m 24^s.56

	h	m	s		s
R.A. of Sun	2	05	30.272	Hourly motion	9.389
R.A. of Moon	14	05	30.272	Hourly motion	140.699
	°	'	"		'
Declination of Sun	+12	43	26.58	Hourly motion	+ 0 49.61
Declination of Moon	-12	23	18.24	Hourly motion	-16 07.43
Equatorial hor. par. of Sun			8.75	True semidiameter of Sun	15 54.1
Equatorial hor. par. of Moon	61	12.06		True semidiameter of Moon	16 40.5

CIRCUMSTANCES OF THE ECLIPSE

	d	h	m	
Moon enters penumbra	April	24	09 28.9	} E.T.
Moon enters umbra		24	10 25.3	
Total eclipse begins		24	11 27.6	
Middle of the eclipse		24	12 07.1	
Total eclipse ends		24	12 46.4	
Moon leaves umbra		24	13 48.8	
Moon leaves penumbra		24	14 45.2	

Contacts of Umbra with Limb of Moon	Position Angles from the North Point	The Moon being in the Zenith in	
		Ephemeris Longitude	Latitude
First	132 to E.	+157 34	-12 00
Last	81 to W.	-153 25	-12 54

Magnitude of the eclipse 1.342

II.—*Partial Eclipse of the Sun, May 9.*

ELEMENTS OF THE ECLIPSE

E.T. of geocentric conjunction in right ascension, May 9^d 15^h 36^m 04^s.47

	^h °	^m '	^s "		^s °	^s "
R.A. of Sun and Moon	3	03	25.891	Hourly motions	9.733	and 118.683
Declination of Sun	+17	17	13.76	Hourly motion	+ 0	40.21
Declination of Moon	+18	24	02.96	Hourly motion	+10	57.22
Equatorial hor. par. of Sun			8.72	True semidiameter of Sun	15	50.5
Equatorial hor. par. of Moon	54	31.10		True semidiameter of Moon	14	51.3

CIRCUMSTANCES OF THE ECLIPSE

	E.T.	Ephemeris Longitude	Latitude
	d h m	° '	° '
Eclipse begins	May 9 12 37.3	+108 12	+24 05
Greatest eclipse	9 14 42.8	+168 30	+62 37
Eclipse ends	9 16 47.8	- 54 34	+62 52

Magnitude of greatest eclipse 0.721

III.—*Total Eclipse of the Moon, October 18*; the beginning of the penumbral phase visible in North America, the northwestern part of the Atlantic Ocean, most of South America, the Pacific Ocean, the east coast of Australia, New Zealand, the northeastern part of Asia, and the arctic regions; the end visible in North America except the east coast, the Pacific Ocean except the southeastern part, Australia, New Zealand, Asia except the southwestern part, the eastern part of the Indian Ocean, and the arctic regions.

ELEMENTS OF THE ECLIPSE

E.T. of geocentric opposition in right ascension, October 18^d 09^h 53^m 14^s.81

	^h °	^m '	^s "		^s °
R.A. of Sun	13	30	07.244	Hourly motion	9.357
R.A. of Moon	1	30	07.244	Hourly motion	107.144
Declination of Sun	-9	26	05.77	Hourly motion	- 0 54.71
Declination of Moon	+9	03	53.16	Hourly motion	+13 23.29
Equatorial hor. par. of Sun			8.83	True semidiameter of Sun	16 03.3
Equatorial hor. par. of Moon	54	00.16		True semidiameter of Moon	14 42.8

CIRCUMSTANCES OF THE ECLIPSE

	d h m	
Moon enters penumbra	October 18 07 10.4	E.T.
Moon enters umbra	18 08 26.0	
Total eclipse begins	18 09 45.4	
Middle of the eclipse	18 10 15.8	
Total eclipse ends	18 10 46.1	
Moon leaves umbra	18 12 05.5	
Moon leaves penumbra	18 13 21.1	

Contacts of Umbra with Limb of Moon	Position Angles from the North Point	The Moon being in the Zenith in Ephemeris Longitude	Latitude
	°	° '	° '
First	41 to E.	+130 46	+8 44
Last	96 to W.	-175 51	+9 33

Magnitude of the eclipse 1.147

IV.—*Total Eclipse of the Sun*, November 2.

ELEMENTS OF THE ECLIPSE

E.T. of geocentric conjunction in right ascension, November 2^d 06^h 25^m 03^s.19

R.A. of Sun and Moon	^h 14	^m 26	^s 59.495	Hourly motions	^s 9.806	^s and 145.323
	°	'	"		'	"
Declination of Sun	-14	32	45.24	Hourly motion	- 0	47.89
Declination of Moon	-15	39	57.43	Hourly motion	-15	24.53
Equatorial hor. par. of Sun			8.87	True semidiameter of Sun	16	07.1
Equatorial hor. par. of Moon	61	25.36		True semidiameter of Moon	16	44.1

CIRCUMSTANCES OF THE ECLIPSE

		E.T.	Ephemeris Longitude	Latitude
		d h m	° '	° '
Eclipse begins	November	2 03 39.0	- 26 53	-16 02
Total eclipse begins		2 05 26.8	+ 18 38	-56 16
Greatest eclipse		2 05 38.9	+ 28 12	-62 09
Total eclipse ends		2 05 50.5	+ 40 12	-67 22
Eclipse ends		2 07 38.5	-179 37	-61 18

The closest approach of the Earth to the axis of shadow is approximately 14 miles, and occurs at the time and place of greatest eclipse. Total phases of this eclipse will occur at all places within the small area noted "Path of Total Eclipse." limited on one side by the curve "Maximum Eclipse at Sunrise."

BESSELIAN ELEMENTS OF THE PARTIAL ECLIPSE OF THE SUN MAY 9

E.T.		Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane
		<i>x</i>	<i>y</i>	<i>sin d</i>	<i>cos d</i>	<i>μ</i>	Penumbra
h	m					° ' "	
12	30	-1.473480	+0.641981	+0.296557	0.955015	8 23 50.5	0.564678
	40	1.394334	0.673585	.296587	.955006	10 53 51.5	.564674
	50	1.315183	0.705183	.296617	.954997	13 23 52.6	.564669
13	00	-1.236025	+0.736774	+0.296646	0.954987	15 53 53.6	0.564664
	10	1.156862	0.768358	.296676	.954978	18 23 54.6	.564658
	20	1.077694	0.799934	.296706	.954969	20 53 55.7	.564651
	30	0.998521	0.831504	.296736	.954960	23 23 56.7	.564644
	40	0.919342	0.863067	.296766	.954950	25 53 57.8	.564637
	50	0.840159	0.894623	.296795	.954941	28 23 58.8	.564628
14	00	-0.760972	+0.926171	+0.296825	0.954932	30 53 59.8	0.564620
	10	0.681781	0.957713	.296855	.954923	33 24 00.9	.564610
	20	0.602586	0.989247	.296885	.954913	35 54 01.9	.564601
	30	0.523388	1.020774	.296915	.954904	38 24 02.9	.564590
	40	0.444185	1.052293	.296944	.954895	40 54 04.0	.564579
	50	0.364980	1.083805	.296974	.954886	43 24 05.0	.564568
15	00	-0.285771	+1.115309	+0.297004	0.954876	45 54 06.0	0.564556
	10	0.206558	1.146804	.297034	.954867	48 24 07.1	.564543
	20	0.127342	1.178292	.297063	.954858	50 54 08.1	.564530
	30	-0.048123	1.209772	.297093	.954848	53 24 09.1	.564516
	40	+0.031100	1.241243	.297123	.954839	55 54 10.2	.564502
	50	0.110325	1.272707	.297153	.954830	58 24 11.2	.564487
16	00	+0.189552	+1.304163	+0.297182	0.954821	60 54 12.2	0.564472
	10	0.268783	1.335611	.297212	.954811	63 24 13.3	.564456
	20	0.348015	1.367052	.297242	.954802	65 54 14.3	.564439
	30	0.427250	1.398484	.297272	.954793	68 24 15.3	.564422
	40	0.506487	1.429909	.297301	.954784	70 54 16.4	.564405
	50	+0.585725	+1.461325	+0.297331	0.954774	73 24 17.4	0.564387

$\tan f_1$ 0.004632
 μ' 0.261830 radians per hour
 d' +0.000187 radians per hour

This map illustrates the path of an eclipse across North America. The map includes latitude and longitude lines, with longitude marked from 130° West to 30° East and latitude from 30° North to 60° North. Key geographical features labeled include ASIA, NORTH AMERICA, SOUTH AMERICA, PACIFIC OCEAN, ATLANTIC OCEAN, and EUROPE. The eclipse path is shown as a series of dashed lines, with labels indicating 'Eclipse begins at Sunrise', 'Maximum Eclipse', 'Eclipse ends at Sunset', and 'LAST CONTACT'. A legend in the bottom right corner defines the line styles: dashed for Semiduration, solid for Middle of Eclipse, and dotted for Ephemeris Time is used. The map also shows the 'Limit' of the eclipse path and the 'FIRST CONTACT' point.

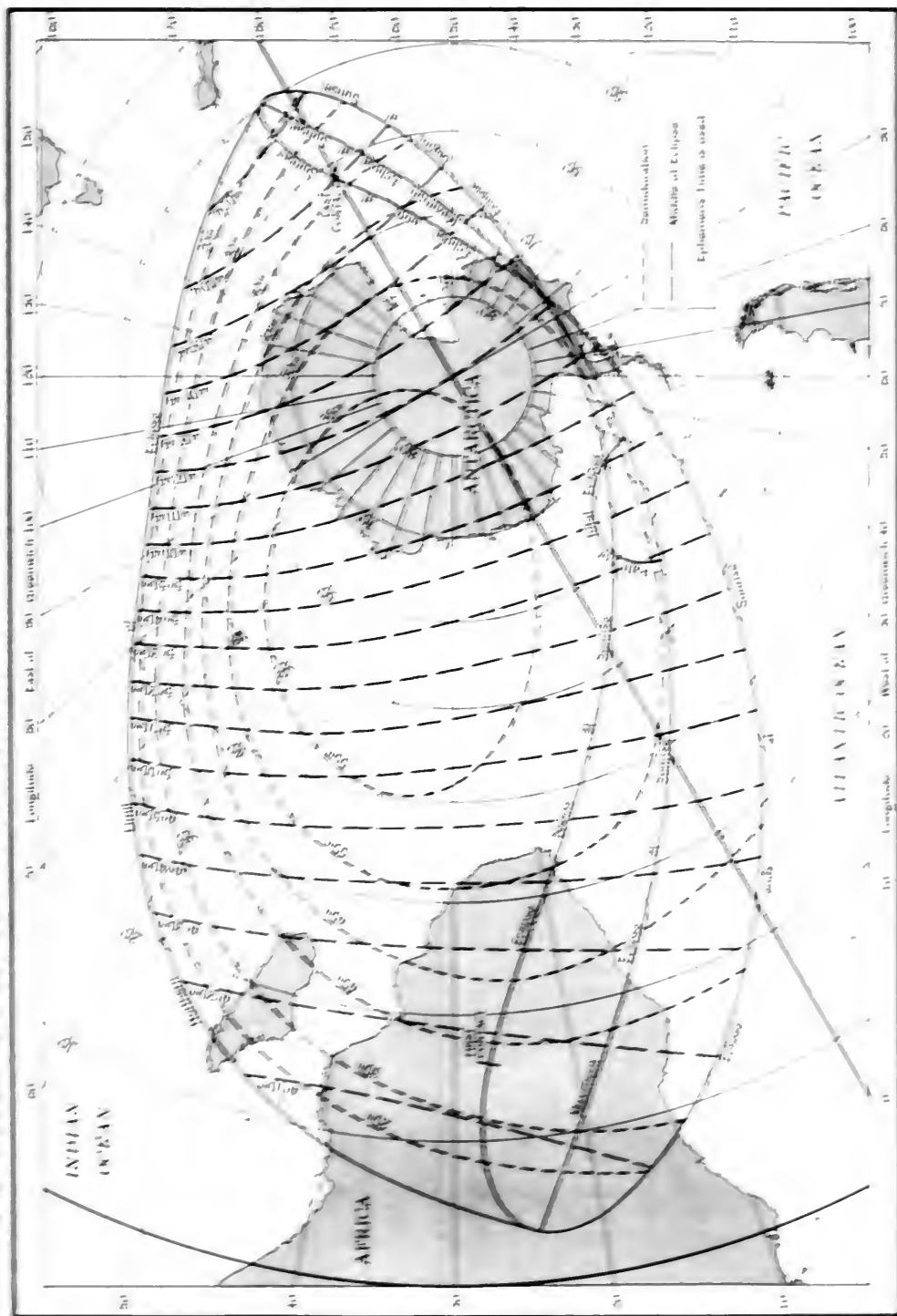
BESSELIAN ELEMENTS OF THE TOTAL ECLIPSE OF THE SUN NOVEMBER 2

E.T.	Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
	<i>x</i>	<i>y</i>	sin <i>d</i>	cos <i>d</i>	μ	Penumbra	Umbra
					$^{\circ}$ $'$ $''$		
h m 3 30	-1.552703	-0.399797	-0.250483	0.968121	236 35 27.8	0.536065	-0.010216
	1.464047	0.439671	.250518	.968112	239 05 28.8	.536076	.010205
	1.375384	0.479538	.250554	.968103	241 35 29.7	.536087	.010195
4 00	-1.286715	-0.519398	-0.250590	0.968093	244 05 30.7	0.536096	-0.010185
	1.198040	0.559251	.250626	.968084	246 35 31.6	.536105	.010176
	1.109359	0.599097	.250662	.968075	249 05 32.6	.536113	.010168
	1.020673	0.638936	.250698	.968065	251 35 33.5	.536121	.010161
	0.931981	0.678768	.250734	.968056	254 05 34.5	.536128	.010154
	0.843285	0.718592	.250769	.968047	256 35 35.4	.536134	.010148
5 00	-0.754584	-0.758408	-0.250805	0.968038	259 05 36.4	0.536139	-0.010143
	0.665878	0.798217	.250841	.968028	261 35 37.3	.536144	.010138
	0.5777169	0.838018	.250877	.968019	264 05 38.2	.536147	.010134
	0.488455	0.877811	.250913	.968010	266 35 39.2	.536151	.010131
	0.399737	0.917596	.250949	.968000	269 05 40.1	.536153	.010129
	0.311017	0.957373	.250984	.967991	271 35 41.1	.536155	.010127
6 00	-0.222293	-0.997142	-0.251020	0.967982	274 05 42.0	0.536156	-0.010126
	0.133566	1.036903	.251056	.967973	276 35 43.0	.536156	.010126
	-0.044837	1.076655	.251092	.967963	279 05 43.9	.536155	.010126
	+0.043894	1.116399	.251128	.967954	281 35 44.8	.536154	.010128
	0.132628	1.156134	.251163	.967945	284 05 45.8	.536152	.010130
	0.221364	1.195861	.251199	.967935	286 35 46.7	.536150	.010132
7 00	+0.310101	-1.235578	-0.251235	0.967926	289 05 47.7	0.536146	-0.010136
	0.398840	1.275287	.251271	.967917	291 35 48.6	.536142	.010140
	0.487581	1.314986	.251307	.967908	294 05 49.5	.536137	.010144
	0.576322	1.354676	.251342	.967898	296 35 50.5	.536132	.010150
	+0.665065	-1.394357	-0.251378	0.967889	299 05 51.4	0.536125	-0.010156
tan <i>f</i> ₁ 0.004712			μ' 0.261827 radians per hour				
tan <i>f</i> ₂ 0.004688			<i>d'</i> -0.000222 radians per hour				

PATH OF TOTAL PHASE DURING THE ECLIPSE OF THE SUN NOVEMBER 2

E.T.	Northern Limit		E.T.	Northern Limit	
	Latitude	Ephemeris Longitude		Latitude	Ephemeris Longitude
Limit	$^{\circ}$ $'$	$^{\circ}$ $'$	h m	$^{\circ}$ $'$	$^{\circ}$ $'$
h m 5 27	-56 16	+18 38	5 39	-65 17.0	+14 20.4
			40	65 47.4	15 08.7
	-57 04.9	+16 11.7			
	58 14.7	14 05.1	41	-66 16.7	+16 05.2
	29 59 06.5	13 05.7	42	66 44.6	17 10.1
30	59 52.2	12 30.3	43	67 11.1	18 24.4
			44	67 35.8	19 49.3
31	-60 34.5	+12 09.4	45	67 58.3	21 26.1
32	61 14.5	11 59.3			
33	61 52.7	11 58.1	46	-68 18.1	+23 16.7
34	62 29.5	12 04.5	47	68 34.2	25 24.3
35	63 05.1	12 18.1	48	68 45.1	27 53.0
			49	68 47.6	30 52.9
36	-63 39.6	+12 38.4	50	68 31.8	34 52.8
37	64 13.0	13 05.6			
38	-64 45.5	+13 39.4	Limit	-67 22	+40 12

TOTAL SOLAR ECLIPSE OF 1967 NOVEMBER 2



EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	P	B ₀	L ₀	Date	P	B ₀	L ₀
	°	°	°		°	°	°
Jan. 0	+ 2.83	-2.89	346.22	Feb. 15	-17.24	-6.82	100.51
1	2.35	3.01	333.05	16	17.57	6.87	87.35
2	1.86	3.12	319.87	17	17.91	6.91	74.18
3	1.38	3.24	306.70	18	18.23	6.94	61.01
4	0.89	3.36	293.53	19	18.55	6.98	47.84
5	+ 0.40	-3.47	280.36	20	-18.87	-7.01	34.67
6	- 0.08	3.58	267.20	21	19.17	7.04	21.50
7	0.57	3.69	254.03	22	19.48	7.07	8.33
8	1.05	3.80	240.86	23	19.77	7.10	355.16
9	1.53	3.91	227.69	24	20.06	7.13	341.99
10	- 2.02	-4.02	214.52	25	-20.35	-7.15	328.82
11	2.50	4.13	201.35	26	20.63	7.17	315.65
12	2.97	4.23	188.19	27	20.90	7.19	302.47
13	3.45	4.34	175.02	28	21.16	7.20	289.30
14	3.93	4.44	161.85	Mar. 1	21.42	7.22	276.13
15	- 4.40	-4.54	148.68	2	-21.68	-7.23	262.96
16	4.87	4.64	135.52	3	21.93	7.24	249.78
17	5.34	4.74	122.35	4	22.17	7.24	236.61
18	5.80	4.83	109.18	5	22.40	7.25	223.44
19	6.26	4.93	96.01	6	22.63	7.25	210.26
20	- 6.72	-5.02	82.85	7	-22.85	-7.25	197.09
21	7.18	5.12	69.68	8	23.07	7.25	183.91
22	7.63	5.21	56.51	9	23.27	7.24	170.73
23	8.08	5.29	43.35	10	23.48	7.24	157.56
24	8.53	5.38	30.18	11	23.67	7.23	144.38
25	- 8.97	-5.47	17.01	12	-23.86	-7.22	131.20
26	9.41	5.55	3.85	13	24.04	7.20	118.03
27	9.84	5.63	350.68	14	24.22	7.19	104.85
28	10.27	5.71	337.51	15	24.39	7.17	91.67
29	10.70	5.79	324.35	16	24.55	7.15	78.49
30	-11.12	-5.87	311.18	17	-24.70	-7.13	65.31
31	11.54	5.94	298.01	18	24.85	7.11	52.12
Feb. 1	11.96	6.01	284.85	19	24.99	7.08	38.94
2	12.36	6.09	271.68	20	25.13	7.05	25.76
3	12.77	6.15	258.51	21	25.26	7.02	12.58
4	-13.17	-6.22	245.35	22	-25.38	-6.99	359.39
5	13.56	6.29	232.18	23	25.49	6.95	346.21
6	13.96	6.35	219.01	24	25.60	6.92	333.02
7	14.34	6.41	205.85	25	25.70	6.88	319.83
8	14.72	6.47	192.68	26	25.79	6.84	306.64
9	-15.10	-6.53	179.52	27	-25.88	-6.80	293.46
10	15.47	6.58	166.35	28	25.95	6.75	280.27
11	15.83	6.63	153.18	29	26.03	6.70	267.08
12	16.19	6.68	140.02	30	26.09	6.66	253.89
13	16.55	6.73	126.85	31	26.15	6.61	240.69
14	-16.89	-6.78	113.68	Apr. 1	-26.20	-6.55	227.50
15	-17.24	-6.82	100.51	2	-26.24	-6.50	214.31

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Apr. 1	-26.20	-6.55	227.50	May 17	-20.65	-2.46	339.83
2	26.24	6.50	214.31	18	20.36	2.35	326.60
3	26.28	6.44	201.12	19	20.07	2.23	313.37
4	26.31	6.38	187.92	20	19.77	2.11	300.15
5	26.33	6.32	174.73	21	19.47	2.00	286.92
6	-26.34	-6.26	161.53	22	-19.16	-1.88	273.69
7	26.35	6.20	148.34	23	18.84	1.76	260.46
8	26.35	6.13	135.14	24	18.51	1.65	247.23
9	26.34	6.06	121.94	25	18.19	1.53	234.00
10	26.33	6.00	108.74	26	17.85	1.41	220.77
11	-26.30	-5.93	95.54	27	-17.51	-1.29	207.53
12	26.27	5.85	82.34	28	17.16	1.17	194.30
13	26.24	5.78	69.14	29	16.81	1.05	181.07
14	26.19	5.70	55.94	30	16.45	0.93	167.84
15	26.14	5.63	42.73	31	16.09	0.81	154.60
16	-26.08	-5.55	29.53	June 1	-15.72	-0.69	141.37
17	26.02	5.47	16.33	2	15.35	0.57	128.14
18	25.94	5.38	3.12	3	14.97	0.45	114.90
19	25.86	5.30	349.91	4	14.59	0.33	101.67
20	25.77	5.21	336.71	5	14.20	0.21	88.43
21	-25.68	-5.13	323.50	6	-13.81	-0.09	75.20
22	25.57	5.04	310.29	7	13.42	+0.03	61.97
23	25.46	4.95	297.08	8	13.02	0.15	48.73
24	25.35	4.86	283.87	9	12.61	0.28	35.50
25	25.22	4.77	270.66	10	12.20	0.40	22.26
26	-25.09	-4.67	257.44	11	-11.79	+0.52	9.02
27	24.95	4.58	244.23	12	11.38	0.64	355.79
28	24.80	4.48	231.02	13	10.96	0.76	342.55
29	24.65	4.39	217.80	14	10.54	0.88	329.32
30	24.49	4.29	204.59	15	10.11	1.00	316.08
May 1	-24.32	-4.19	191.37	16	- 9.68	+1.12	302.84
2	24.14	4.09	178.16	17	9.25	1.23	289.61
3	23.96	3.99	164.94	18	8.82	1.35	276.37
4	23.77	3.88	151.72	19	8.38	1.47	263.13
5	23.57	3.78	138.50	20	7.94	1.59	249.89
6	-23.36	-3.67	125.28	21	- 7.50	+1.71	236.66
7	23.15	3.57	112.06	22	7.06	1.82	223.42
8	22.93	3.46	98.84	23	6.61	1.94	210.18
9	22.71	3.35	85.62	24	6.17	2.06	196.95
10	22.47	3.24	72.40	25	5.72	2.17	183.71
11	-22.23	-3.13	59.18	26	- 5.27	+2.28	170.47
12	21.99	3.02	45.95	27	4.82	2.40	157.23
13	21.73	2.91	32.73	28	4.37	2.51	144.00
14	21.47	2.80	19.51	29	3.92	2.62	130.76
15	21.21	2.69	6.28	30	3.46	2.74	117.52
16	-20.93	-2.57	353.06	July 1	- 3.01	+2.85	104.29
17	-20.65	-2.46	339.83	2	- 2.55	+2.96	91.05

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	P	B ₀	L ₀	Date	P	B ₀	L ₀
	°	°	°		°	°	°
July 1	- 3.01	+2.85	104.29	Aug. 16	+16.15	+6.68	215.77
2	2.55	2.96	91.05	17	16.48	6.72	202.55
3	2.10	3.07	77.82	18	16.82	6.77	189.34
4	1.64	3.18	64.58	19	17.14	6.81	176.12
5	1.19	3.28	51.34	20	17.47	6.85	162.90
6	- 0.73	+3.39	38.11	21	+17.79	+6.89	149.69
7	- 0.28	3.50	24.87	22	18.10	6.93	136.47
8	+ 0.18	3.60	11.64	23	18.41	6.96	123.26
9	0.63	3.71	358.41	24	18.71	7.00	110.04
10	1.08	3.81	345.17	25	19.01	7.03	96.83
11	+ 1.53	+3.91	331.94	26	+19.30	+7.06	83.62
12	1.98	4.01	318.70	27	19.59	7.08	70.40
13	2.43	4.11	305.47	28	19.87	7.11	57.19
14	2.88	4.21	292.24	29	20.15	7.13	43.98
15	3.33	4.31	279.00	30	20.42	7.15	30.77
16	+ 3.77	+4.40	265.77	31	+20.68	+7.17	17.56
17	4.22	4.50	252.54	Sept. 1	20.95	7.19	4.35
18	4.66	4.59	239.31	2	21.20	7.20	351.14
19	5.10	4.69	226.08	3	21.45	7.22	337.93
20	5.53	4.78	212.84	4	21.70	7.23	324.72
21	+ 5.97	+4.87	199.61	5	+21.93	+7.24	311.52
22	6.40	4.96	186.38	6	22.17	7.24	298.31
23	6.83	5.04	173.15	7	22.39	7.25	285.10
24	7.26	5.13	159.92	8	22.62	7.25	271.90
25	7.68	5.22	146.69	9	22.83	7.25	258.69
26	+ 8.10	+5.30	133.46	10	+23.04	+7.25	245.49
27	8.52	5.38	120.23	11	23.24	7.24	232.28
28	8.94	5.46	107.01	12	23.44	7.24	219.08
29	9.35	5.54	93.78	13	23.63	7.23	205.88
30	9.76	5.62	80.55	14	23.82	7.22	192.67
31	+10.17	+5.69	67.32	15	+24.00	+7.21	179.47
Aug. 1	10.57	5.77	54.10	16	24.17	7.19	166.27
2	10.97	5.84	40.87	17	24.34	7.18	153.07
3	11.37	5.91	27.65	18	24.50	7.16	139.86
4	11.76	5.98	14.42	19	24.65	7.14	126.66
5	+12.15	+6.05	1.20	20	+24.80	+7.12	113.46
6	12.53	6.11	347.98	21	24.94	7.09	100.26
7	12.91	6.18	334.75	22	25.08	7.06	87.06
8	13.29	6.24	321.53	23	25.20	7.03	73.86
9	13.66	6.30	308.31	24	25.33	7.00	60.66
10	+14.03	+6.36	295.09	25	+25.44	+6.97	47.47
11	14.39	6.42	281.87	26	25.55	6.93	34.27
12	14.75	6.47	268.65	27	25.65	6.90	21.07
13	15.11	6.53	255.43	28	25.75	6.86	7.87
14	15.46	6.58	242.21	29	25.83	6.82	354.68
15	+15.81	+6.63	228.99	30	+25.92	+6.77	341.48
16	+16.15	+6.68	215.77	Oct. 1	+25.99	+6.73	328.29

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀	Date	<i>P</i>	<i>B</i> ₀	<i>L</i> ₀
	°	°	°		°	°	°
Oct. 1	+25.99	+6.73	328.29	Nov. 16	+21.36	+2.75	81.61
2	26.06	6.68	315.09	17	21.08	2.64	68.43
3	26.12	6.63	301.90	18	20.79	2.52	55.25
4	26.17	6.58	288.70	19	20.49	2.40	42.06
5	26.22	6.53	275.51	20	20.19	2.28	28.88
6	+26.26	+6.47	262.31	21	+19.88	+2.15	15.70
7	26.29	6.41	249.12	22	19.56	2.03	2.52
8	26.32	6.35	235.93	23	19.23	1.91	349.34
9	26.34	6.29	222.73	24	18.90	1.79	336.16
10	26.35	6.23	209.54	25	18.56	1.66	322.98
11	+26.35	+6.17	196.35	26	+18.21	+1.54	309.80
12	26.35	6.10	183.16	27	17.86	1.41	296.62
13	26.33	6.03	169.97	28	17.50	1.29	283.44
14	26.31	5.96	156.77	29	17.14	1.16	270.26
15	26.29	5.89	143.58	30	16.76	1.04	257.08
16	+26.25	+5.81	130.39	Dec. 1	+16.38	+0.91	243.90
17	26.21	5.74	117.20	2	16.00	0.78	230.72
18	26.16	5.66	104.01	3	15.61	0.65	217.54
19	26.11	5.58	90.82	4	15.21	0.53	204.37
20	26.04	5.50	77.63	5	14.81	0.40	191.19
21	+25.97	+5.42	64.44	6	+14.40	+0.27	178.01
22	25.89	5.33	51.25	7	13.99	0.14	164.83
23	25.80	5.25	38.06	8	13.57	+0.01	151.66
24	25.71	5.16	24.87	9	13.15	-0.11	138.48
25	25.61	5.07	11.68	10	12.72	0.24	125.30
26	+25.50	+4.98	358.50	11	+12.29	-0.37	112.13
27	25.38	4.88	345.31	12	11.85	0.50	98.95
28	25.25	4.79	332.12	13	11.41	0.63	85.77
29	25.12	4.70	318.93	14	10.97	0.75	72.60
30	24.97	4.60	305.75	15	10.52	0.88	59.42
31	+24.82	+4.50	292.56	16	+10.06	-1.01	46.25
Nov. 1	24.67	4.40	279.38	17	9.61	1.14	33.07
2	24.50	4.30	266.19	18	9.15	1.26	19.90
3	24.33	4.20	253.00	19	8.68	1.39	6.72
4	24.15	4.09	239.82	20	8.22	1.51	353.55
5	+23.96	+3.99	226.63	21	+ 7.75	-1.64	340.38
6	23.76	3.88	213.45	22	7.28	1.76	327.20
7	23.55	3.77	200.26	23	6.80	1.89	314.03
8	23.34	3.66	187.08	24	6.33	2.01	300.86
9	23.12	3.55	173.90	25	5.85	2.14	287.68
10	+22.89	+3.44	160.71	26	+ 5.37	-2.26	274.51
11	22.65	3.33	147.53	27	4.89	2.38	261.34
12	22.41	3.22	134.34	28	4.41	2.50	248.17
13	22.16	3.10	121.16	29	3.92	2.62	235.00
14	21.90	2.99	107.98	30	3.44	2.74	221.83
15	+21.63	+2.87	94.79	31	+ 2.95	-2.86	208.66
16	+21.36	+2.75	81.61	32	+ 2.46	-2.98	195.49

EPHEMERIS FOR PHYSICAL OBSERVATIONS

TABLE OF AMOUNT TO BE SUBTRACTED FROM L_0 AT 0^h U.T. TO OBTAIN
THE VALUE OF L_0 AT ANY UNIVERSAL TIME

U.T. h	Daily Motion								
	13.16	13.17	13.18	13.19	13.20	13.21	13.22	13.23	13.24
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
2	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	1.64	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.66
4	2.19	2.20	2.20	2.20	2.20	2.20	2.20	2.21	2.21
5	2.74	2.74	2.75	2.75	2.75	2.75	2.75	2.76	2.76
6	3.29	3.29	3.30	3.30	3.30	3.30	3.30	3.31	3.31
7	3.84	3.84	3.84	3.85	3.85	3.85	3.86	3.86	3.86
8	4.39	4.39	4.39	4.40	4.40	4.40	4.41	4.41	4.41
9	4.93	4.94	4.94	4.95	4.95	4.95	4.96	4.96	4.97
10	5.48	5.49	5.49	5.50	5.50	5.50	5.51	5.51	5.52
11	6.03	6.04	6.04	6.05	6.05	6.05	6.06	6.06	6.07
12	6.58	6.59	6.59	6.59	6.60	6.61	6.61	6.62	6.62
13	7.13	7.13	7.14	7.14	7.15	7.16	7.16	7.17	7.17
14	7.68	7.68	7.69	7.69	7.70	7.71	7.71	7.72	7.72
15	8.22	8.23	8.24	8.24	8.25	8.26	8.26	8.27	8.28
16	8.77	8.78	8.79	8.79	8.80	8.81	8.81	8.82	8.83
17	9.32	9.33	9.34	9.34	9.35	9.36	9.36	9.37	9.38
18	9.87	9.88	9.89	9.89	9.90	9.91	9.91	9.92	9.93
19	10.42	10.43	10.43	10.44	10.45	10.46	10.47	10.47	10.48
20	10.97	10.98	10.98	10.99	11.00	11.01	11.02	11.03	11.03
21	11.51	11.52	11.53	11.54	11.55	11.56	11.57	11.58	11.59
22	12.06	12.07	12.08	12.09	12.10	12.11	12.12	12.13	12.14
23	12.61	12.62	12.63	12.64	12.65	12.66	12.67	12.68	12.69

The following critical table is to be used for all values of the daily motion.

m	m	m	m	m	m	m
00.0 0.00	08.1 0.08	16.9 0.16	25.6 0.24	34.3 0.32	43.0 0.40	51.8 0.48
00.5 0.01	09.2 0.09	18.0 0.17	26.7 0.25	35.4 0.33	44.1 0.41	52.9 0.49
01.6 0.02	10.3 0.10	19.0 0.18	27.8 0.26	36.5 0.34	45.2 0.42	54.0 0.50
02.7 0.03	11.4 0.11	20.1 0.19	28.9 0.27	37.6 0.35	46.3 0.43	55.0 0.51
03.8 0.04	12.5 0.12	21.2 0.20	30.0 0.28	38.7 0.36	47.4 0.44	56.1 0.52
04.9 0.05	13.6 0.13	22.3 0.21	31.0 0.29	39.8 0.37	48.5 0.45	57.2 0.53
06.0 0.06	14.7 0.14	23.4 0.22	32.1 0.30	40.9 0.38	49.6 0.46	58.3 0.54
07.0 0.07	15.8 0.15	24.5 0.23	33.2 0.31	42.0 0.39	50.7 0.47	59.4 0.55
08.1 0.07	16.9 0.15	25.6 0.23	34.3 0.31	43.0 0.39	51.8 0.47	60.0 0.55

In critical cases ascend.

EPHEMERIS FOR PHYSICAL OBSERVATIONS

SYNODIC ROTATION NUMBERS

Rotation No.	Date of commencement		Rotation No.	Date of commencement		Rotation No.	Date of commencement	
1409	1959	Jan. 2.51	1450	1962	Jan. 24.85	1490	1965	Jan. 19.85
1410		Jan. 29.85	1451		Feb. 21.19	1491		Feb. 16.19
1411		Feb. 26.19	1452		Mar. 20.51	1492		Mar. 15.52
1412		Mar. 25.51	1453		Apr. 16.80	1493		Apr. 11.81
1413		Apr. 21.79	1454		May 14.04	1494		May 9.06
1414		May 19.02	1455		June 10.24	1495		June 5.27
1415		June 15.22	1456		July 7.44	1496		July 2.46
1416		July 12.42	1457		Aug. 3.65	1497		July 29.67
1417		Aug. 8.64	1458		Aug. 30.89	1498		Aug. 25.90
1418		Sept. 4.88	1459		Sept. 27.16	1499		Sept. 22.16
1419		Oct. 2.15	1460		Oct. 24.44	1500		Oct. 19.45
1420		Oct. 29.44	1461		Nov. 20.75	1501		Nov. 15.75
1421		Nov. 25.75	1462		Dec. 18.07	1502		Dec. 13.07
1422		Dec. 23.07	1463	1963	Jan. 14.40	1503	1966	Jan. 9.40
1423	1960	Jan. 19.40	1464		Feb. 10.74	1504		Feb. 5.74
1424		Feb. 15.75	1465		Mar. 10.08	1505		Mar. 5.08
1425		Mar. 14.07	1466		Apr. 6.38	1506		Apr. 1.38
1426		Apr. 10.37	1467		May 3.63	1507		Apr. 28.65
1427		May 7.62	1468		May 30.85	1508		May 25.87
1428		June 3.83				1509		June 22.07
1429		July 1.03	1469		June 27.05	1510		July 19.27
1430		July 28.23	1470		July 24.25	1511		Aug. 15.50
1431		Aug. 24.46	1471		Aug. 20.48	1512		Sept. 11.75
1432		Sept. 20.72	1472		Sept. 16.73	1513		Oct. 9.02
1433		Oct. 18.01	1473		Oct. 14.02	1514		Nov. 5.32
1434		Nov. 14.31	1474		Nov. 10.31	1515		Dec. 2.63
1435		Dec. 11.63	1475		Dec. 7.63	1516		Dec. 29.95
1436	1961	Jan. 7.96	1476	1964	Jan. 3.95	1517	1967	Jan. 26.29
1437		Feb. 4.30	1477		Jan. 31.29	1518		Feb. 22.63
1438		Mar. 3.63	1478		Feb. 27.63	1519		Mar. 21.95
1439		Mar. 30.94	1479		Mar. 25.95	1520		Apr. 18.24
1440		Apr. 27.21	1480		Apr. 22.22	1521		May 15.48
1441		May 24.44	1481		May 19.46	1522		June 11.68
1442		June 20.64	1482		June 15.66	1523		July 8.88
1443		July 17.84	1483		July 12.86	1524		Aug. 5.09
1444		Aug. 14.06	1484		Aug. 9.07	1525		Sept. 1.33
1445		Sept. 10.31	1485		Sept. 5.32	1526		Sept. 28.60
1446		Oct. 7.58	1486		Oct. 2.59	1527		Oct. 25.89
1447		Nov. 3.88	1487		Oct. 29.88	1528		Nov. 22.19
1448		Dec. 1.19	1488		Nov. 26.19	1529		Dec. 19.51
1449		Dec. 28.51	1489		Dec. 23.51			

The synodic rotations are numbered in continuation of Carrington's Greenwich Photo-heliographic series, of which No. 1 commenced on 1853 November 9.

EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated	
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb		
Jan.	0	18.9 ^d	-2.08 ^o	-6.55 ^o	0 +3 +1	134.51 ^o	-1.25 ^o	19.00 ^o	103.7 ^o	0.87 ^o
	1	19.9	-0.93 ^{+1.15}	6.15 ^{+0.40}	0 3 2	146.64	1.27	21.35 ^{+2.35}	108.7 ^{+5.0}	0.78
	2	20.9	+0.18 ^{1.11}	5.37 ^{0.78}	0 3 2	158.78	1.29	22.39 ^{+1.04}	111.7 ^{3.0}	0.68
	3	21.9	1.21 ^{1.03}	4.25 ^{1.12}	0 3 2	170.93	1.30	22.21 ^{-0.18}	112.9 ^{+1.2}	0.57
	4	22.9	2.11 ^{0.90}	2.88 ^{1.37}	+1 3 2	183.09	1.32	20.92 ^{1.29}	112.5 ^{-0.4}	0.45
			0.77 ^{1.53}					2.33	2.1	
	5	23.9	+2.88 ^{+0.63}	-1.35 ^{+1.60}	+1 +3 +2	195.25	-1.34	18.59 ^{-3.33}	110.4 ^{-3.7}	0.34
	6	24.9	3.51 ^{0.51}	+0.25 ^{1.56}	1 3 2	207.42	1.35	15.26 ^{4.27}	106.7 ^{5.5}	0.24
	7	25.9	4.02 ^{0.37}	1.81 ^{1.45}	1 3 2	219.59	1.37	10.99 ^{5.06}	101.2 ^{-7.6}	0.15
	8	26.9	4.39 ^{0.24}	3.26 ^{1.25}	1 3 2	231.77	1.39	5.93 ^{5.56}	93.6 ^{..}	0.08
	9	27.9	4.63 ^{+0.06}	4.51 ^{0.99}	1 3 2	243.96	1.40	0.37 ^{5.63}	82.8 ^{..}	0.03
	10	28.9	+4.69 ^{-0.13}	+5.50 ^{+0.68}	+1 +3 +2	256.14	-1.42	354.74 ^{-5.21}	61.0 ^{..}	0.01
	11	0.2	4.56 ^{0.35}	6.18 ^{0.36}	1 3 2	268.33	1.43	349.53 ^{4.41}	318.1 ^{..}	0.00
	12	1.2	4.21 ^{0.60}	6.54 ^{+0.03}	1 3 2	280.52	1.45	345.12 ^{3.40}	273.6 ^{..}	0.02
	13	2.2	3.61 ^{0.83}	6.57 ^{-0.28}	1 3 2	292.71	1.46	341.72 ^{2.34}	261.6 ^{-6.5}	0.05
	14	3.2	2.78 ^{1.06}	6.29 ^{0.55}	+1 3 2	304.89	1.47	339.38 ^{1.35}	255.1 ^{4.0}	0.10
	15	4.2	+1.72 ^{-1.23}	+5.74 ^{-0.80}	0 +3 +2	317.07	-1.47	338.03 ^{-0.44}	251.1 ^{-2.3}	0.17
	16	5.2	+0.49 ^{1.35}	4.94 ^{1.00}	0 3 1	329.25	1.48	337.59 ^{+0.38}	248.8 ^{-1.0}	0.25
	17	6.2	-0.86 ^{1.39}	3.94 ^{1.17}	0 3 1	341.42	1.49	337.97 ^{1.15}	247.8 ^{+0.2}	0.33
	18	7.2	2.25 ^{1.34}	2.77 ^{1.30}	0 3 1	353.59	1.49	339.12 ^{1.92}	248.0 ^{1.5}	0.42
	19	8.2	3.59 ^{1.19}	1.47 ^{1.38}	0 3 1	5.75	1.49	341.04 ^{2.70}	249.5 ^{2.7}	0.52
	20	9.2	-4.78 ^{-0.95}	+0.09 ^{-1.40}	0 +3 +1	17.90	-1.50	343.74 ^{+3.54}	252.2 ^{+4.0}	0.61
	21	10.2	5.73 ^{0.60}	-1.31 ^{1.38}	0 3 1	30.05	1.50	347.28 ^{4.38}	256.2 ^{5.6}	0.70
	22	11.2	6.33 ^{-0.20}	2.69 ^{1.28}	0 3 1	42.19	1.51	351.66 ^{5.17}	261.8 ^{7.2}	0.79
	23	12.2	6.53 ^{+0.25}	3.97 ^{1.10}	0 3 1	54.33	1.51	356.83 ^{5.70}	269.0 ^{+9.3}	0.87
	24	13.2	6.28 ^{0.70}	5.07 ^{0.84}	-1 2 1	66.46	1.51	2.53 ^{5.76}	278.3 ^{..}	0.93
	25	14.2	-5.58 ^{+1.11}	-5.91 ^{-0.49}	-1 +2 +1	78.59	-1.51	8.29 ^{+5.26}	292.2 ^{..}	0.98
	26	15.2	4.47 ^{1.41}	6.40 ^{-0.10}	1 2 1	90.72	1.52	13.55 ^{4.22}	335.9 ^{..}	1.00
	27	16.2	3.06 ^{1.58}	6.50 ^{+0.33}	1 2 2	102.84	1.52	17.77 ^{2.89}	81.1 ^{..}	0.99
	28	17.2	-1.48 ^{1.60}	6.17 ^{0.75}	-1 2 2	114.97	1.52	20.66 ^{1.50}	100.4 ^{..}	0.96
	29	18.2	+0.12 ^{1.50}	5.42 ^{1.10}	0 2 2	127.10	1.52	22.16 ^{+0.18}	107.5 ^{+7.1}	0.90
								3.3	3.3	
Feb.	30	19.2	+1.62 ^{+1.28}	-4.32 ^{+1.37}	0 +2 +2	139.24	-1.51	22.34 ^{-1.01}	110.8 ^{+0.8}	0.81
	31	20.2	2.90 ^{1.03}	2.95 ^{1.54}	0 2 2	151.38	1.51	21.33 ^{2.11}	111.6 ^{-1.1}	0.72
	1	21.2	3.93 ^{0.75}	-1.41 ^{1.59}	0 2 2	163.53	1.51	19.22 ^{3.11}	110.5 ^{2.9}	0.61
	2	22.2	4.68 ^{0.49}	+0.18 ^{1.56}	0 2 2	175.68	1.51	16.11 ^{4.05}	107.6 ^{4.4}	0.50
	3	23.2	5.17 ^{0.26}	1.74 ^{1.43}	0 2 2	187.85	1.52	12.06 ^{4.84}	103.2 ^{5.8}	0.39
	4	24.2	+5.43 ^{+0.05}	+3.17 ^{+1.24}	0 +2 +2	200.02	-1.52	7.22 ^{-5.39}	97.4 ^{-7.1}	0.28
	5	25.2	5.48 ^{-0.12}	4.41 ^{0.98}	0 2 2	212.19	1.52	1.83 ^{5.56}	90.3 ^{8.0}	0.19
	6	26.2	5.36 ^{0.30}	5.39 ^{0.70}	0 3 2	224.38	1.52	356.27 ^{5.28}	82.3 ^{-9.3}	0.12
	7	27.2	5.06 ^{0.46}	6.09 ^{0.39}	0 3 2	236.56	1.53	350.99 ^{4.61}	73.0 ^{..}	0.06
	8	28.2	4.60 ^{0.63}	6.48 ^{+0.06}	0 3 2	248.76	1.53	346.38 ^{3.67}	60.5 ^{..}	0.02
	9	29.2	+3.97 ^{-0.82}	+6.54 ^{-0.24}	0 +3 +2	260.95	-1.53	342.71 ^{-2.66}	28.3 ^{..}	0.00
	10	0.6	3.15 ^{1.00}	6.30 ^{0.52}	0 3 2	273.14	1.53	340.05 ^{1.65}	287.1 ^{..}	0.00
	11	1.6	2.15 ^{1.16}	5.78 ^{0.78}	0 3 2	285.34	1.53	338.40 ^{-0.72}	261.4 ^{-7.7}	0.02
	12	2.6	+0.99 ^{1.30}	5.00 ^{0.98}	0 3 2	297.53	1.52	337.68 ^{+0.12}	253.7 ^{3.4}	0.06
	13	3.6	-0.31 ^{1.39}	4.02 ^{1.16}	-1 3 1	309.72	1.52	337.80 ^{0.90}	250.3 ^{-1.2}	0.11
	14	4.6	-1.70 ^{-1.43}	+2.86 ^{-1.28}	-1 +3 +1	321.91	-1.51	338.70 ^{+1.64}	249.1 ^{+0.4}	0.18
	15	5.6	-3.13	+1.58	-1 +3 +1	334.09	-1.51	340.34	249.5	0.26

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
		°	°	(0°01)	°	°	°	°	
Feb. 15	5.6	-3.13	+1.58	-1 +3 +1	334.09	-1.51	340.34	249.5	0.26
16	6.6	-1.37	-1.35	1 2 1	346.27	1.50	342.75	251.2	0.34
17	7.6	1.23	1.38	1 2 1	358.44	1.49	345.94	254.3	0.44
18	8.6	1.00	1.35	1 2 1	10.61	1.48	349.94	258.6	0.53
19	9.6	0.66	1.27	1 2 1	22.77	1.47	354.72	264.2	0.63
		-0.24	1.12				5.40	6.8	
20	10.6	-7.63	-4.89	-1 +2 +1	34.93	-1.46	0.12	271.0	0.73
21	11.6	+0.24	-0.88	1 2 1	47.07	1.44	5.81	278.7	0.82
22	12.6	0.76	0.59	1 2 1	59.22	1.43	11.29	287.2	0.90
23	13.6	1.23	-0.21	1 2 2	71.36	1.41	15.99	297.1	0.95
24	14.6	1.62	+0.22	1 2 2	83.49	1.40	19.52	314.9	0.99
		1.89	0.66				2.14	..	
25	15.6	-1.89	-5.69	-1 +2 +2	95.63	-1.38	21.66	62.6	1.00
26	16.6	+0.07	4.63	1 2 2	107.77	1.36	22.39	102.5	0.98
27	17.6	1.88	1.38	1 2 2	119.91	1.34	21.81	109.1	0.92
28	18.6	1.64	1.59	1 2 2	132.05	1.32	20.02	110.3	0.85
Mar. 1	19.6	0.96	1.63	1 2 2	144.20	1.31	17.13	108.7	0.76
							3.90	3.6	
2	20.6	+5.87	+1.64	-1 +2 +2	156.36	-1.29	13.23	105.1	0.65
3	21.6	+0.59	+1.49	1 2 2	168.52	1.28	8.47	100.0	0.54
4	22.6	+0.25	1.29	1 2 2	180.70	1.26	3.12	93.8	0.43
5	23.6	-0.05	1.01	0 2 2	192.88	1.25	5.57	86.9	0.33
6	24.6	0.32	0.72	0 2 2	205.06	1.24	5.36	79.9	0.24
		0.54	0.41				4.75	6.9	
7	25.6	+5.80	+6.56	0 +2 +2	217.25	-1.23	347.44	73.0	0.16
8	26.6	-0.73	+0.09	-1 2 2	229.45	1.22	343.56	66.4	0.09
9	27.6	0.89	-0.22	1 2 2	241.65	1.21	340.68	59.5	0.05
10	28.6	1.05	0.50	1 2 2	253.86	1.20	338.79	49.3	0.01
11	29.6	1.18	0.76	1 2 2	266.07	1.19	337.82	4.4	0.00
		1.28	0.98				-0.11	..	
12	0.8	+0.67	+4.19	-1 +2 +2	278.27	-1.17	337.71	266.1	0.01
13	1.8	-1.37	-1.16	1 2 1	290.48	1.16	338.39	253.4	0.03
14	2.8	1.42	1.29	1 2 1	302.69	1.14	339.82	250.5	0.07
15	3.8	1.41	1.37	1 2 1	314.89	1.13	342.00	250.7	0.12
16	4.8	1.35	1.39	1 2 1	327.09	1.11	344.94	252.7	0.19
		1.21	1.36				3.71	3.5	
17	5.8	-6.09	-2.38	-1 +2 +1	339.29	-1.09	348.65	256.2	0.27
18	6.8	-1.00	-1.27	2 2 1	351.48	1.07	353.12	261.0	0.37
19	7.8	0.69	1.14	2 2 1	3.66	1.05	358.23	266.8	0.46
20	8.8	-0.31	0.93	2 2 1	15.84	1.02	3.72	273.5	0.57
21	9.8	+0.14	0.65	2 2 1	28.01	1.00	9.17	280.4	0.67
		0.63	-0.32				4.94	6.9	
22	10.8	-7.32	-6.69	-2 +2 +2	40.18	-0.97	14.11	287.3	0.77
23	11.8	+1.12	+0.08	2 2 2	52.34	0.94	18.08	293.6	0.86
24	12.8	1.55	0.51	2 2 2	64.50	0.92	20.81	299.4	0.93
25	13.8	1.87	0.94	1 2 2	76.65	0.89	22.19	306.5	0.98
26	14.8	2.06	1.31	1 2 2	88.81	0.85	22.21	349.4	1.00
		2.05	1.60				-1.27	..	
27	15.8	+1.33	-2.25	-1 +2 +2	100.96	-0.82	20.94	104.5	0.99
28	16.8	+1.90	-0.51	1 2 2	113.11	0.79	18.45	109.2	0.95
29	17.8	1.61	1.75	1 2 2	125.27	0.76	14.82	107.5	0.88
30	18.8	1.24	1.62	1 2 2	137.44	0.73	10.19	103.2	0.80
31	19.8	0.82	1.41	1 2 2	149.61	0.71	4.82	97.4	0.70
		0.41	1.12				5.71	6.6	
Apr. 1	20.8	+7.31	+5.39	-1 +2 +2	161.78	-0.68	359.11	90.8	0.59
2	21.8	+0.02	+6.19	-1 +2 +2	173.97	-0.66	353.53	84.0	0.49

EPHEMERIS FOR PHYSICAL OBSERVATIONS
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		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb		
Apr.	1	20.8	+7.31	+5.39	-1 +2 +2	161.78	-0.68	359.11	90.8	0.59
	2	21.8	7.33	6.19	1 2 2	173.97	0.66	353.53	84.0	0.49
	3	22.8	7.00	6.66	1 2 2	186.16	0.64	348.54	77.6	0.39
	4	23.8	6.38	6.79	1 2 2	198.36	0.62	344.42	72.0	0.29
	5	24.8	5.51	6.62	1 2 2	210.57	0.60	341.30	67.2	0.21
	6	25.8	+4.44	+6.14	-1 +2 +2	222.78	-0.58	339.18	63.4	0.13
	7	26.8	3.23	5.41	1 2 2	234.99	0.56	338.01	60.4	0.08
	8	27.8	1.92	4.45	1 2 2	247.21	0.54	337.69	57.7	0.03
	9	28.8	+0.54	3.30	1 2 2	259.44	0.53	338.17	52.9	0.01
	10	0.1	-0.86	2.01	1 2 2	271.66	0.51	339.40	311.7	0.00
	11	1.1	-2.26	+0.63	-1 +2 +1	283.88	-0.49	341.38	252.0	0.01
	12	2.1	3.59	-0.79	1 2 1	296.11	0.46	344.13	251.0	0.04
	13	3.1	4.83	2.18	2 2 1	308.33	0.44	347.64	253.6	0.08
	14	4.1	5.91	3.49	2 2 1	320.55	0.42	351.92	257.8	0.14
	15	5.1	6.79	4.65	2 2 1	332.76	0.39	356.84	263.2	0.22
16	6.1	-7.40	-5.62	-2 +2 +2	344.97	-0.37	2.17	269.5	0.31	
17	7.1	7.69	6.34	2 2 2	357.18	0.34	7.56	276.0	0.41	
18	8.1	7.61	6.74	2 2 2	9.38	0.31	12.56	282.5	0.51	
19	9.1	7.12	6.78	2 2 2	21.57	0.28	16.77	288.2	0.62	
20	10.1	6.21	6.42	2 2 2	33.76	0.25	19.88	292.9	0.73	
21	11.1	-4.92	-5.65	-2 +2 +2	45.94	-0.21	21.75	296.4	0.83	
22	12.1	3.30	4.49	1 2 2	58.11	0.18	22.34	298.4	0.91	
23	13.1	-1.46	3.00	1 2 2	70.28	0.14	21.66	299.0	0.97	
24	14.1	+0.48	-1.29	1 2 2	82.45	0.10	19.75	299.2	1.00	
25	15.1	2.37	+0.51	1 2 2	94.62	0.07	16.62	111.3	1.00	
26	16.1	+4.07	+2.25	-1 +2 +2	106.79	-0.03	12.34	108.3	0.97	
27	17.1	5.47	3.81	1 2 2	118.96	+0.01	7.11	102.6	0.91	
28	18.1	6.49	5.09	1 2 2	131.14	0.04	1.29	95.9	0.83	
29	19.1	7.09	6.03	1 2 2	143.33	0.07	355.43	88.8	0.74	
30	20.1	7.25	6.61	1 2 2	155.52	0.09	350.05	82.0	0.65	
May	1	21.1	+7.01	+6.84	-1 +2 +2	167.72	+0.12	345.54	76.1	0.54
	2	22.1	6.41	6.73	1 2 2	179.92	0.14	342.08	71.2	0.44
	3	23.1	5.52	6.32	1 2 2	192.13	0.16	339.68	67.5	0.35
	4	24.1	4.39	5.63	1 2 2	204.35	0.19	338.26	65.0	0.26
	5	25.1	3.10	4.71	1 2 2	216.57	0.21	337.72	63.6	0.18
	6	26.1	+1.72	+3.60	-1 +2 +2	228.80	+0.22	337.99	63.3	0.11
	7	27.1	+0.31	2.33	1 2 2	241.03	0.24	339.02	64.3	0.06
	8	28.1	-1.08	+0.96	1 2 2	253.27	0.26	340.80	67.0	0.02
	9	29.1	2.39	-0.46	1 2 2	265.51	0.28	343.35	74.8	0.00
	10	0.4	3.58	1.87	1 2 2	277.75	0.30	346.68	236.2	0.00
	11	1.4	-4.62	-3.21	-1 +1 +2	289.99	+0.33	350.80	250.5	0.02
	12	2.4	5.47	4.42	1 1 2	302.22	0.35	355.61	257.7	0.05
	13	3.4	6.10	5.43	1 1 2	314.46	0.37	0.89	264.7	0.11
	14	4.4	6.48	6.20	1 1 2	326.69	0.39	6.29	271.7	0.18
	15	5.4	6.61	6.66	1 1 2	338.92	0.42	11.38	278.4	0.27
16	6.4	-6.44	-6.78	-1 +1 +2	351.14	+0.44	15.74	284.3	0.37	
17	7.4	-5.99	-6.53	-1 +1 +2	3.36	+0.47	19.08	289.2	0.48	

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		Longitude	Latitude		Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb						
		d	°	°		(0°01)	°	°		°	°				
May	17	7.4	-5.99		-6.53		-1	+1	+2	3.36	+0.47	19.08	289.2	0.48	
	18	8.4	5.24	+0.75	5.89	+0.64	1	1	2	15.57	0.50	21.26	292.8	0.59	
	19	9.4	4.21	1.03	4.88	1.01	1	1	2	27.77	0.53	22.25	294.9	0.70	
	20	10.4	2.93	1.28	3.54	1.34	1	1	2	39.96	0.57	22.05	295.4	0.80	
	21	11.4	-1.45	1.48	1.96	1.58	1	1	2	52.15	0.60	20.67	294.0	0.89	
				1.59		1.74									
	22	12.4	+0.14		-0.22		-1	+1	+2	64.34	+0.64	18.11	290.0	0.95	
	23	13.4	1.77	+1.63	+1.53	+1.75	-1	1	2	76.52	0.67	14.37	280.3	0.99	
	24	14.4	3.30	1.53	3.16	1.63	0	1	2	88.71	0.70	9.54	150.3	1.00	
	25	15.4	4.63	1.33	4.57	1.41	0	1	2	100.89	0.74	3.88	107.3	0.98	
	26	16.4	5.67	1.04	5.65	1.08	0	1	2	113.08	0.77	357.87	96.5	0.94	
				0.66		0.73									
	27	17.4	+6.33		+6.38		0	+1	+2	125.27	+0.79	352.11	88.1	0.87	
	28	18.4	6.58	+0.25	6.73	+0.35	0	1	2	137.46	0.82	347.12	81.0	0.79	
	29	19.4	6.42	-0.16	6.72	-0.01	0	1	2	149.66	0.84	343.19	75.2	0.70	
	30	20.4	5.87	0.55	6.39	0.33	0	1	2	161.87	0.86	340.38	70.9	0.61	
	31	21.4	5.00	0.87	5.76	0.63	0	1	2	174.08	0.88	338.63	67.8	0.51	
				1.13		0.87									
	June	1	22.4	+3.87		+4.89		0	+1	+2	186.30	+0.90	337.82	66.0	0.41
		2	23.4	2.56	-1.31	3.83	-1.06	0	1	2	198.52	0.91	337.86	65.4	0.32
3		24.4	+1.17	1.39	2.60	1.23	0	1	2	210.76	0.93	338.66	66.0	0.24	
4		25.4	-0.24	1.41	+1.27	1.33	-1	1	2	222.99	0.94	340.22	67.8	0.16	
5		26.4	1.57	1.33	-0.13	1.40	1	1	2	235.23	0.96	342.53	71.1	0.10	
				1.20		1.40									
6		27.4	-2.77		-1.53		-1	+1	+2	247.48	+0.97	345.64	76.6	0.05	
7		28.4	3.79	-1.02	2.88	-1.35	1	1	2	259.73	0.99	349.56	86.9	0.02	
8		29.4	4.58	0.79	4.11	1.23	1	1	2	271.97	1.00	354.23	134.3	0.00	
9		0.8	5.12	0.54	5.17	1.06	1	1	2	284.22	1.02	359.47	245.2	0.01	
	10	1.8	5.40	0.28	5.98	0.81	1	1	2	296.47	1.03	4.94	262.5	0.03	
				-0.04		0.52									
	11	2.8	-5.44		-6.50		-1	+1	+2	308.72	+1.05	10.19	272.3	0.08	
	12	3.8	5.24	+0.20	6.67	-0.17	1	1	2	320.96	1.06	14.78	279.8	0.15	
	13	4.8	4.85	0.39	6.48	+0.19	1	1	2	333.20	1.08	18.37	285.6	0.24	
	14	5.8	4.27	0.58	5.91	0.57	1	1	2	345.43	1.10	20.82	290.0	0.34	
	15	6.8	3.52	0.75	4.99	0.92	1	1	2	357.66	1.12	22.08	292.7	0.45	
				0.88		1.23									
	16	7.8	-2.64	+1.02	-3.76	+1.47	-1	+1	+2	9.88	+1.14	22.20	293.8	0.56	
	17	8.8	1.62	1.13	2.29	1.63	0	1	2	22.09	1.16	21.20	293.3	0.67	
	18	9.8	-0.49	1.20	-0.66	1.68	0	1	2	34.30	1.19	19.09	291.0	0.78	
	19	10.8	+0.71	1.22	+1.02	1.61	0	1	2	46.50	1.21	15.86	286.5	0.87	
	20	11.8	1.93	1.18	2.63	1.44	0	1	2	58.69	1.24	11.52	279.4	0.94	
	21	12.8	+3.11		+4.07		0	+1	+2	70.88	+1.26	6.24	266.7	0.98	
	22	13.8	4.16	+1.05	5.24	+1.17	0	1	2	83.07	1.29	0.35	215.5	1.00	
	23	14.8	4.99	0.83	6.07	0.83	0	1	2	95.26	1.31	354.43	109.0	0.99	
	24	15.8	5.52	0.53	6.53	0.46	+1	1	2	107.46	1.33	349.04	90.9	0.96	
	25	16.8	5.71	+0.19	6.62	+0.09	1	1	2	119.65	1.35	344.62	81.6	0.91	
				-0.19		-0.25									
	26	17.8	+5.52		+6.37		+1	+1	+2	131.85	+1.36	341.34	75.3	0.84	
	27	18.8	4.96	-0.56	5.81	-0.56	0	1	2	144.05	1.37	339.18	71.1	0.76	
	28	19.8	4.09	0.87	4.99	0.82	0	1	2	156.26	1.39	338.04	68.4	0.67	
	29	20.8	2.96	1.13	3.97	1.02	0	1	2	168.48	1.39	337.79	67.0	0.57	
	30	21.8	1.65	1.31	2.78	1.19	0	1	2	180.70	1.40	338.34	66.8	0.48	
				1.39		1.29									
	July	1	22.8	+0.26		+1.49		0	+1	+2	192.92	+1.41	339.64	67.8	0.39
		2	23.8	-1.13	-1.39	+0.12	-1.37	0	+1	+2	205.16	+1.41	341.70	70.1	0.30

EPOCHS FOR PHYSICAL OBSERVATIONS

FOR 0^b UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated	
		Longitude	Latitude	Ig. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb		
July		^d	[°]	[°]	^(0°01)	[°]	[°]	[°]		
	1	22.8	+0.26	+1.49	0 +1 +2	192.92	+1.41	339.64	67.8	0.39
	2	23.8	-1.13	-1.39	0 1 2	205.16	1.41	341.70	+2.06 70.1	+2.3 0.30
	3	24.8	2.41	1.28	0 1 2	217.39	1.42	344.53	2.83 73.7	3.6 0.21
	4	25.8	3.51	1.10	0 1 2	229.64	1.42	348.18	3.65 78.8	5.1 0.14
	5	26.8	4.36	0.85	0 1 2	241.88	1.43	352.62	4.44 86.0	+7.2 0.08
			0.55	3.83				5.11		
	6	27.8	-4.91	-0.23	0 +1 +2	254.13	+1.43	357.73	96.6	0.03
	7	28.8	5.14	-0.85	0 1 2	266.39	1.44	3.22	+5.49 119.2	.. 0.01
	8	0.3	5.06	+0.08	0 1 2	278.64	1.44	8.67	5.45 225.0	.. 0.00
	9	1.3	4.69	0.37	0 1 2	290.89	1.44	13.56	4.89 266.7	.. 0.02
	10	2.3	4.09	0.60	0 1 2	303.14	1.45	17.51	3.95 279.0	.. 0.06
			0.77	6.41				2.78	+6.9	
	11	3.3	-3.32	-5.89	0 +1 +2	315.39	+1.45	20.29	285.9	0.13
	12	4.3	2.46	+0.86	0 1 2	327.63	1.46	21.85	+1.56 290.1	+4.2 0.21
	13	5.3	1.54	0.92	0 1 2	339.87	1.46	22.24	+0.39 292.3	2.2 0.31
	14	6.3	-0.62	0.92	0 1 2	352.10	1.47	21.51	-0.73 292.6	+0.3 0.42
	15	7.3	+0.30	0.91	0 1 2	4.32	1.48	19.70	1.81 291.3	-1.3 0.54
				1.62				2.88	3.2	
	16	8.3	+1.21	+0.81	+1 +1 +2	16.54	+1.49	16.82	288.1	0.65
	17	9.3	2.09	+0.88	1 1 2	28.74	1.50	12.89	-3.93 283.2	-4.9 0.76
	18	10.3	2.93	0.84	1 1 2	40.95	1.52	7.98	4.91 276.4	6.8 0.85
	19	11.3	3.71	0.78	1 1 2	53.14	1.53	2.37	5.61 267.5	-8.9 0.92
	20	12.3	4.36	0.65	1 1 2	65.34	1.54	356.50	5.87 255.3	.. 0.97
			0.48	5.86				5.56	..	
	21	13.3	+4.84	+6.38	+1 +1 +2	77.53	+1.55	350.94	-4.78 228.8	.. 0.99
	22	14.3	5.08	+0.24	1 1 2	89.72	1.55	346.16	3.70 122.2	.. 1.00
	23	15.3	5.05	-0.03	1 1 2	101.91	1.56	342.46	2.57 87.6	.. 0.98
	24	16.3	4.70	0.35	1 1 2	114.10	1.56	339.89	1.51 77.3	-5.4 0.94
	25	17.3	4.04	0.66	1 1 2	126.30	1.56	338.38	-0.57 71.9	2.8 0.88
		0.94	5.08							
26	18.3	+3.10	+4.08	+1 +1 +2	138.50	+1.56	337.81	+0.27 69.1	-1.3 0.81	
27	19.3	1.93	-1.17	1 1 2	150.70	1.56	338.08	1.05 67.8	+0.2 0.73	
28	20.3	+0.60	1.33	1 1 2	162.91	1.56	339.13	1.79 68.0	1.4 0.64	
29	21.3	-0.81	1.41	1 1 2	175.13	1.55	340.92	2.55 69.4	2.6 0.55	
30	22.3	2.19	1.38	1 1 2	187.35	1.55	343.47	3.33 72.0	3.9 0.45	
		1.26	-1.07							
Aug.	31	23.3	-3.45	-2.40	+1 +1 +2	199.58	+1.54	346.80	75.9	0.36
	1	24.3	4.50	3.63	1 1 2	211.81	1.53	350.93	+4.13 81.1	+5.2 0.27
	2	25.3	5.25	4.73	+1 +1 2	224.04	1.53	355.79	4.86 87.6	6.5 0.19
	3	26.3	5.65	5.62	0 0 2	236.29	1.52	1.17	5.38 95.6	8.0 0.11
	4	27.3	5.66	6.24	0 0 2	248.53	1.51	6.70	5.53 105.5	+9.9 0.06
			+0.39	-0.29				5.18	..	
	5	28.3	-5.27	-6.53	0 0 2	260.78	+1.50	11.88	120.4	0.02
	6	29.3	4.54	6.45	+1 0 2	273.03	1.49	16.24	+4.36 179.2	.. 0.00
	7	0.9	3.54	5.98	1 0 2	285.28	1.48	19.49	3.25 268.9	.. 0.01
	8	1.9	2.36	5.13	1 0 2	297.53	1.47	21.47	1.98 284.1	.. 0.05
	9	2.9	-1.11	3.94	1 0 2	309.77	1.47	22.22	+0.75 289.6	+5.5 0.11
			1.24	1.44				-0.44	+2.1	
	10	3.9	+0.13	-2.50	+1 0 +2	322.01	+1.46	21.78	291.7	0.19
	11	4.9	1.27	-0.91	1 0 2	334.24	1.45	20.23	-1.55 291.4	-0.3 0.29
	12	5.9	2.29	+0.73	1 0 2	346.47	1.45	17.59	2.64 289.2	2.2 0.40
	13	6.9	3.17	2.31	1 0 2	358.69	1.44	13.90	3.69 285.3	3.9 0.52
14	7.9	3.90	3.74	1 0 2	10.90	1.44	9.24	4.66 279.7	5.6 0.63	
		0.59	1.18				5.39	6.8		
15	8.9	+4.49	+4.92	+2 0 +2	23.10	+1.43	3.85	272.9	0.73	
16	9.9	+4.93	+5.82	+2 +1 +2	35.30	+1.43	358.09	-5.76 265.0	-7.9 0.82	

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
		^d	[°]	[°]	[°]	[°]	[°]	[°]	
Aug. 16	9.9	+4.93	+5.82	+2 +1 +2	35.30	+1.43	358.09	265.0	0.82
17	10.9	5.20 +0.27	6.38 +0.56	2 1 2	47.49	1.43	352.50	256.5 -8.5	0.90
18	11.9	5.29 +0.09	6.59 +0.21	2 1 2	59.68	1.42	347.54	246.9 -9.6	0.95
19	12.9	5.17 -0.12	6.45 -0.14	2 1 2	71.87	1.41	343.55	232.8	0.99
20	13.9	4.82 0.35	5.99 0.46	2 1 2	84.05	1.41	340.64	354.7	1.00
		0.61	0.75				1.84		
21	14.9	+4.21	+5.24	+2 +1 +2	96.24	+1.40	338.80	88.7	0.99
22	15.9	3.37 -0.84	4.26 -0.98	2 0 2	108.42	1.38	337.93	74.8	0.96
23	16.9	2.29 1.08	3.09 1.17	2 0 2	120.61	1.37	337.93	70.2 -4.6	0.92
24	17.9	+1.04 1.25	1.81 1.28	1 0 2	132.80	1.36	338.72	68.6 -1.6	0.86
25	18.9	-0.33 1.37	+0.46 1.35	1 0 2	144.99	1.34	340.25	68.9 +0.3	0.79
		1.43	1.38				2.29	1.8	
26	19.9	-1.76	-0.92	+1 0 +2	157.19	+1.33	342.54	70.7	0.71
27	20.9	3.15 -1.39	2.25 -1.33	1 0 2	169.39	1.31	345.58	73.7 +3.0	0.62
28	21.9	4.42 1.27	3.50 1.25	1 0 2	181.60	1.29	349.40	77.9 4.2	0.52
29	22.9	5.46 1.04	4.62 1.12	1 0 2	193.81	1.27	353.95	83.3 5.4	0.43
30	23.9	6.20 0.74	5.54 0.92	1 0 2	206.03	1.26	359.10	89.8 6.5	0.33
		-0.36	0.68				5.44	7.1	
Sept. 31	24.9	-6.56	-6.22	+1 0 +2	218.26	+1.24	4.54	96.9	0.24
1	25.9	6.49 +0.07	6.60 -0.38	1 0 2	230.49	1.22	9.85	104.5 +7.6	0.15
2	26.9	5.98 0.51	6.62 -0.02	1 0 2	242.72	1.20	14.57	112.4 7.9	0.08
3	27.9	5.04 0.94	6.24 +0.38	1 0 2	254.96	1.18	18.29	121.7 +9.3	0.03
4	28.9	3.76 1.28	5.47 0.77	1 0 2	267.20	1.16	20.81	143.9	0.00
		1.52	1.15				+1.24		
5	0.5	-2.24	-4.32	+1 0 +2	279.44	+1.14	22.05	268.3	0.00
6	1.5	-0.61 +1.63	2.87 +1.45	1 0 2	291.67	1.12	22.04	287.7	0.03
7	2.5	+1.00 1.61	-1.23 1.64	1 0 2	303.91	1.10	20.83	291.0 +3.3	0.09
8	3.5	2.49 1.49	+0.49 1.72	2 0 2	316.14	1.08	18.47	290.3 -0.7	0.17
9	4.5	3.78 1.29	2.16 1.67	2 0 2	328.36	1.06	14.98	287.3 3.0	0.27
		1.05	1.50				4.51	4.8	
10	5.5	+4.83	+3.66	+2 0 +2	340.58	+1.04	10.47	282.5	0.37
11	6.5	5.61 +0.78	4.91 +1.25	2 0 2	352.79	1.02	5.16	276.3 -6.2	0.49
12	7.5	6.12 0.51	5.86 0.95	2 0 2	4.99	1.01	359.43	269.3 7.0	0.60
13	8.5	6.37 -0.25	6.46 0.60	2 0 2	17.19	0.99	353.77	262.0 7.3	0.70
14	9.5	6.37 0.00	6.71 +0.25	2 0 2	29.38	0.97	348.68	255.1 6.9	0.79
		-0.24	-0.10				4.20	6.4	
15	10.5	+6.13	+6.61	+2 0 +2	41.56	+0.95	344.48	248.7	0.87
16	11.5	5.67 -0.46	6.19 -0.42	2 0 2	53.74	0.93	341.34	242.8 -5.9	0.93
17	12.5	4.99 0.68	5.47 0.72	2 0 2	65.91	0.91	339.24	236.5 -6.3	0.97
18	13.5	4.11 0.88	4.51 0.96	2 0 2	78.08	0.89	338.11	223.5	0.99
19	14.5	3.04 1.07	3.36 1.15	2 0 2	90.26	0.87	337.87	105.0 -0.24	1.00
		1.22	1.29				+0.55		
20	15.5	+1.82	+2.07	+2 0 +2	102.43	+0.85	338.42	73.1	0.98
21	16.5	+0.47 -1.35	+0.70 -1.37	2 0 2	114.60	0.82	339.73	69.3 -3.8	0.95
22	17.5	-0.94 1.41	-0.70 1.40	2 0 2	126.78	0.80	341.78	69.5 +0.2	0.90
23	18.5	2.38 1.44	2.06 1.36	1 0 2	138.95	0.77	344.58	71.6 2.1	0.84
24	19.5	3.76 1.38	3.34 1.28	1 0 2	151.13	0.75	348.14	75.1 3.5	0.77
		1.26	1.15				4.29	4.8	
25	20.5	-5.02	-4.49	+1 0 +2	163.32	+0.72	352.43	79.9	0.68
26	21.5	6.07 -1.05	5.46 -0.97	1 0 2	175.51	0.70	357.33	85.6 +5.7	0.59
27	22.5	6.84 0.77	6.20 0.74	1 0 2	187.71	0.67	2.60	92.0 6.4	0.49
28	23.5	7.25 -0.41	6.66 0.46	1 0 2	199.91	0.65	7.89	98.7 6.7	0.39
29	24.5	7.24 +0.01	6.79 -0.13	1 0 2	212.11	0.62	12.76	105.2 6.5	0.29
		0.46	+0.24				4.87	5.9	
							4.08		
Oct. 30	25.5	-6.78	-6.55	+1 0 +2	224.33	+0.60	16.84	111.1	0.20
1	26.5	-5.87 +0.91	-5.91 +0.64	+1 0 +2	236.54	+0.57	19.84	116.1 +5.0	0.11

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Age	The Earth's Selenographic		Physical Libration	The Sun's Selenographic		Position Angle of		Fraction Illuminated
		Longitude	Latitude	Lg. Lt. P.A.	Colong.	Lat.	Axis	Bright Limb	
				(0°01)					
Nov. 16	13.8	-0.03	-1.46	+1 -1 +2	76.99	-0.70	343.01	256.2	0.99
17	14.8	1.39	2.79	1 1 2	89.13	0.73	346.18	298.5	1.00
18	15.8	2.67	4.00	1 1 2	101.27	0.75	350.10	59.6	0.99
19	16.8	3.82	5.05	1 1 2	113.42	0.77	354.71	73.0	0.97
20	17.8	4.82	5.88	+1 1 2	125.56	0.80	359.78	81.5	0.93
21	18.8	-5.64	-6.46	0 -1 +2	137.70	-0.82	5.01	89.1	0.87
22	19.8	6.26	6.73	0 1 2	149.85	0.84	10.01	96.1	0.79
23	20.8	6.64	6.68	0 1 2	162.00	0.86	14.39	102.3	0.71
24	21.8	6.76	6.29	0 1 2	174.16	0.88	17.91	107.4	0.61
25	22.8	6.58	5.55	0 1 2	186.32	0.90	20.39	111.3	0.50
26	23.8	-6.08	-4.48	0 -1 +2	198.49	-0.92	21.80	113.7	0.39
27	24.8	5.23	3.13	+1 1 2	210.67	0.93	22.11	114.6	0.29
28	25.8	4.05	-1.54	1 1 2	222.85	0.96	21.31	113.8	0.19
29	26.8	2.56	+0.18	1 1 2	235.04	0.98	19.34	110.7	0.10
30	27.8	-0.83	1.91	1 1 2	247.23	1.00	16.14	104.3	0.04
Dec. 1	28.8	+1.03	+3.52	+1 -1 +2	259.43	-1.02	11.68	87.2	0.01
2	0.3	2.88	4.88	1 1 2	271.62	1.04	6.15	316.4	0.00
3	1.3	4.57	5.89	1 1 2	283.82	1.07	359.99	284.0	0.03
4	2.3	5.95	6.49	1 1 2	296.01	1.09	353.86	272.1	0.08
5	3.3	6.92	6.67	1 1 2	308.20	1.11	348.43	263.5	0.15
6	4.3	+7.42	+6.47	+1 -1 +2	320.38	-1.13	344.11	256.8	0.23
7	5.3	7.43	5.92	1 1 2	332.56	1.16	341.00	251.9	0.33
8	6.3	7.00	5.10	1 1 2	344.73	1.18	339.04	248.6	0.43
9	7.3	6.19	4.05	1 1 2	356.90	1.20	338.07	246.7	0.52
10	8.3	5.08	2.85	1 1 2	9.05	1.22	337.97	246.0	0.62
11	9.3	+3.78	+1.54	+1 -1 +2	21.20	-1.24	338.65	246.6	0.71
12	10.3	2.37	+0.17	+1 1 2	33.35	1.26	340.08	248.4	0.79
13	11.3	+0.93	-1.20	0 1 2	45.49	1.28	342.25	251.7	0.86
14	12.3	-0.46	2.52	0 1 2	57.63	1.30	345.20	256.7	0.92
15	13.3	1.74	3.74	0 1 2	69.76	1.32	348.92	264.6	0.96
16	14.3	-2.86	-4.80	0 -1 +2	81.89	-1.33	353.38	280.6	0.99
17	15.3	3.79	5.66	0 1 2	94.02	1.35	358.39	1.6	1.00
18	16.3	4.52	6.26	0 1 2	106.15	1.36	3.67	71.2	0.99
19	17.3	5.05	6.57	0 1 2	118.28	1.37	8.81	87.1	0.96
20	18.3	5.38	6.56	0 1 2	130.42	1.38	13.40	96.5	0.91
21	19.3	-5.52	-6.21	0 -1 +2	142.55	-1.38	17.14	103.2	0.84
22	20.3	5.47	5.53	0 1 2	154.69	1.39	19.86	108.2	0.75
23	21.3	5.24	4.53	0 1 2	166.84	1.40	21.51	111.5	0.66
24	22.3	4.80	3.27	0 1 2	178.99	1.40	22.11	113.2	0.55
25	23.3	4.15	1.79	0 1 2	191.15	1.41	21.66	113.3	0.44
26	24.3	-3.26	-0.18	0 -1 +2	203.31	-1.41	20.14	111.7	0.33
27	25.3	2.13	+1.46	0 1 2	215.49	1.42	17.49	108.2	0.22
28	26.3	-0.79	3.03	0 1 2	227.66	1.43	13.65	102.5	0.13
29	27.3	+0.69	4.42	0 1 2	239.85	1.44	8.66	93.8	0.06
30	28.3	2.23	5.50	0 1 2	252.03	1.45	2.80	78.9	0.02
31	29.3	+3.69	+6.22	0 -1 +2	264.22	-1.46	356.60	20.3	0.00
32	0.8	+4.93	+6.53	0 -1 +2	276.41	-1.47	350.77	284.4	0.01

ILLUMINATED DISK
FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Θ	<i>L</i>	Stellar Mag.	Date	<i>k</i>	<i>i</i>	Θ	<i>L</i>	Stellar Mag.
Jan. 0	0.962		°	25.5	-0.5	July 4	0.033		°	5.3	+2.6
5	.979	+17	23 87	24.9 - 0.6	0.6	9	.009	...	159 302	1.5 ..	3.1
10	.991	12	17 79	25.3 + 0.4	0.7	14	.030	...	169 357	5.0 ..	2.6
15	.997	6	11 66	26.9 1.6	0.9	19	.098	+68	160 61	15.0 +10.0	1.9
20	.998	+1	6 36	29.9 3.0	1.0	24	.207	109	143 77	28.3 13.3	1.2
		-10	6 316	4.9				143	126 85	14.2	
25	0.988		12 278	34.8	-1.0	29	0.350		107 90	42.5	+0.5
30	.962	-26	23 265	42.2 + 7.4	1.0	Aug. 3	.521	+171	88 96	56.2 +13.7	-0.1
Feb. 4	.904	58	158 218	10.2	1.0	8	.703	182	66 102	66.5 10.3	0.7
9	.797	107	54 251	11.4	0.9	13	.861	158	44 110	68.9 + 2.4	1.1
14	.622	175	76 246	+6.0	-0.5	18	.959	98	23 121	62.5 - 6.4	1.4
		227		-9.6				+37		10.2	
19	0.395		102 242	60.2	+0.1	23	0.996		7 156	52.3	-1.5
24	.175	-220	130 236	-26.7	1.0	28	.992	-4	10 265	43.0 - 9.3	1.3
Mar. 1	.035	-140	158 218	-26.0	2.2	Sept. 2	.969	23	20 283	36.2 6.8	0.9
6	.013	...	167 114	2.7 ..	2.7	7	.937	32	29 289	31.7 4.6	0.6
11	.086	...	146 80	14.7 ..	1.9	12	.902	35	37 292	29.0 2.7	0.4
		+113		+11.8				38		1.3	
16	0.199		127 73	26.5	+1.3	17	0.864		43 294	27.7	-0.2
21	.313	+114	112 69	32.0 + 5.5	0.9	22	.823	-41	50 295	27.6 - 0.1	0.0
26	.412	99	100 67	33.3 + 1.3	0.7	27	.775	48	57 295	28.6 + 1.0	+0.1
31	.497	85	90 65	32.9 - 0.4	0.5	Oct. 2	.719	56	64 295	30.7 2.1	0.1
Apr. 5	.571	74	82 63	32.3 - 0.6	0.4	7	.648	71	73 295	33.8 3.1	0.2
		66		0.0				93		3.8	
10	0.637		74 62	32.3	+0.3	12	0.555		84 294	37.6	+0.3
15	.700	+63	66 61	33.2 + 0.9	+0.1	17	.433	-122	98 294	40.4 + 2.8	0.5
20	.763	63	58 60	35.4 2.2	-0.1	22	.276	157	117 295	37.1 - 3.3	0.8
25	.829	66	49 60	39.3 3.9	0.4	27	.105	-171	142 298	20.1 -17.0	1.6
30	.896	67	38 61	45.3 6.0	0.8	Nov. 1	.002	...	175 316	0.5 ..	3.0
		62		8.3				...		...
May 5	0.958		24 63	53.6	-1.3	6	0.074		148 115	17.0	+1.7
10	.997	+39	6 67	62.5 + 8.9	1.8	11	.291	+217	115 117	50.2 +33.2	+0.5
15	.986	-11	14 248	68.0 + 5.5	1.7	16	.525	234	87 116	60.7 +10.6	-0.2
20	.913	73	34 253	66.2 - 1.8	1.3	21	.701	176	66 115	54.4 - 6.3	0.5
25	.798	115	53 258	58.8 7.4	0.8	26	.817	116	51 112	44.7 9.7	0.5
		125		8.6				72		8.0	
30	0.673		70 262	50.2	-0.3	Dec. 1	0.889		39 109	36.7	-0.6
June 4	.554	-119	84 267	43.0 - 7.2	+0.1	6	.935	+46	30 105	31.1 - 5.6	0.6
9	.447	107	96 271	37.3 5.7	0.5	11	.963	28	22 99	27.5 3.6	0.6
14	.349	98	108 275	32.4 4.9	0.8	16	.982	19	16 92	25.4 2.1	0.6
19	.257	92	119 279	27.3 5.1	1.2	21	.993	11	10 80	24.5 - 0.9	0.7
		87		6.3				+5		+0.2	
24	0.170		131 283	21.0	+1.5	26	0.998		5 49	24.7	-0.8
29	.092	-78	145 289	13.1 - 7.9	2.0	31	.998	0	5 322	26.1 + 1.4	0.8
July 4	0.033	-59	159 302	5.3 - 7.8	+2.6	36	0.992	-6	10 288	28.8 + 2.7	-0.8

ILLUMINATED DISK
FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	θ	<i>L</i>	Stellar Mag.	Date	<i>k</i>	<i>i</i>	θ	<i>L</i>	Stellar Mag.
Jan. 0	0.978	17.2	266.2	47.6	-3.4	July 4	0.416	99.7	289.1	155.0	-4.1
5	.973	18.8	263.8	48.0	3.4	9	.382	103.6	290.4	163.1	4.1
10	.968	20.5	261.5	48.5	3.3	14	.346	107.9	291.7	170.4	4.1
15	.963	22.1	259.3	49.1	3.3	19	.309	112.5	293.0	176.1	4.2
20	.958	23.8	257.3	49.7	3.3	24	.268	117.6	294.5	178.7	4.2
25	0.951	25.5	255.5	50.3	-3.3	29	0.225	123.3	296.2	176.2	-4.2
30	.945	27.2	253.8	51.1	3.3	Aug. 3	.181	129.6	298.3	166.1	4.1
Feb. 4	.938	28.9	252.4	51.9	3.3	8	.136	136.7	301.3	146.1	4.1
9	.930	30.6	251.1	52.7	3.3	13	.093	144.5	305.7	115.2	3.9
14	.922	32.3	250.1	53.7	3.3	18	.055	153.0	313.1	76.8	3.7
19	0.914	34.1	249.4	54.7	-3.3	23	0.026	161.4	327.7	40.1	-3.4
24	.905	35.9	248.8	55.8	3.4	28	.012	167.6	1.6	18.9	3.2
Mar. 1	.895	37.8	248.5	57.0	3.4	Sept. 2	.014	166.3	50.8	23.2	3.3
6	.885	39.6	248.4	58.3	3.4	7	.033	158.9	77.2	51.5	3.6
11	.874	41.5	248.6	59.7	3.4	12	.066	150.3	88.8	92.4	3.8
16	0.863	43.5	248.9	61.2	-3.4	17	0.106	141.9	95.2	132.5	-4.0
21	.851	45.4	249.6	62.8	3.4	22	.151	134.2	99.3	163.5	4.2
26	.838	47.5	250.4	64.5	3.4	27	.197	127.4	102.3	182.9	4.2
31	.825	49.5	251.5	66.4	3.4	Oct. 2	.241	121.2	104.7	192.3	4.3
Apr. 5	.811	51.6	252.8	68.4	3.5	7	.283	115.7	106.7	194.2	4.3
10	0.796	53.7	254.4	70.6	-3.5	12	0.323	110.8	108.4	191.1	-4.3
15	.780	55.9	256.1	72.9	3.5	17	.360	106.3	109.9	185.0	4.2
20	.764	58.1	258.1	75.5	3.5	22	.394	102.2	111.2	177.2	4.2
25	.747	60.4	260.2	78.3	3.5	27	.427	98.4	112.3	168.7	4.2
30	.730	62.7	262.4	81.3	3.6	Nov. 1	.457	94.9	113.2	160.0	4.1
May 5	0.711	65.0	264.8	84.5	-3.6	6	0.486	91.6	113.9	151.5	-4.1
10	.692	67.4	267.2	88.1	3.6	11	.513	88.5	114.4	143.4	4.0
15	.672	69.9	269.6	92.0	3.6	16	.539	85.6	114.6	135.7	4.0
20	.651	72.4	272.1	96.3	3.7	21	.563	82.8	114.6	128.5	3.9
25	.629	75.0	274.4	100.9	3.7	26	.586	80.1	114.3	121.9	3.9
30	0.607	77.7	276.7	106.0	-3.7	Dec. 1	0.608	77.5	113.8	115.7	-3.8
June 4	.583	80.4	278.9	111.5	3.8	6	.629	75.0	113.1	110.0	3.8
9	.558	83.3	280.9	117.5	3.8	11	.650	72.6	112.0	104.8	3.8
14	.533	86.3	282.8	124.1	3.9	16	.669	70.3	110.8	99.9	3.7
19	.506	89.4	284.6	131.2	3.9	21	.687	68.0	109.3	95.4	3.7
24	0.477	92.6	286.2	138.8	-4.0	26	0.705	65.8	107.5	91.3	-3.7
29	.447	96.1	287.7	146.8	4.0	31	.722	63.6	105.5	87.4	3.6
July 4	0.416	99.7	289.1	155.0	-4.1	36	0.738	61.5	103.3	83.9	-3.6

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
	m		"	°	°	°	°	°
Jan. 0	11.88	+1.1	6.55	286.45	+22.14	-39.03	+22.33	69.20
2	11.71	1.1	6.64	287.45	21.98	39.09	22.47	70.07
4	11.54	1.1	6.74	288.43	21.82	39.14	22.60	70.94
6	11.38	1.0	6.84	289.39	21.66	39.16	22.72	71.82
8	11.21	1.0	6.94	290.34	21.50	39.17	22.84	72.69
10	11.04	+1.0	7.04	291.26	+21.33	-39.16	+22.95	73.56
12	10.87	0.9	7.15	292.17	21.16	39.12	23.06	74.44
14	10.71	0.9	7.27	293.06	20.98	39.07	23.16	75.31
16	10.54	0.9	7.38	293.93	20.81	38.99	23.25	76.19
18	10.37	0.8	7.50	294.77	20.63	38.89	23.34	77.06
20	10.20	+0.8	7.62	295.60	+20.45	-38.76	+23.42	77.94
22	10.03	0.7	7.75	296.41	20.27	38.62	23.50	78.82
24	9.87	0.7	7.88	297.19	20.09	38.45	23.58	79.69
26	9.70	0.7	8.02	297.95	19.92	38.25	23.64	80.57
28	9.53	0.6	8.16	298.68	19.74	38.03	23.70	81.45
30	9.37	+0.6	8.30	299.39	+19.57	-37.78	+23.76	82.33
Feb. 1	9.20	0.5	8.45	300.08	19.39	37.51	23.81	83.21
3	9.04	0.5	8.60	300.73	19.23	37.20	23.85	84.09
5	8.88	0.5	8.76	301.36	19.06	36.87	23.89	84.97
7	8.72	0.4	8.92	301.96	18.90	36.50	23.92	85.85
9	8.55	+0.4	9.09	302.53	+18.75	-36.11	+23.94	86.73
11	8.40	0.3	9.26	303.07	18.60	35.68	23.96	87.62
13	8.24	0.3	9.44	303.57	18.46	35.21	23.98	88.50
15	8.08	0.2	9.62	304.04	18.32	34.72	23.98	89.39
17	7.93	0.2	9.81	304.48	18.19	34.18	23.99	90.27
19	7.77	+0.1	10.01	304.88	+18.08	-33.61	+23.98	91.16
21	7.62	+0.1	10.20	305.24	17.97	33.00	23.97	92.05
23	7.47	0.0	10.41	305.57	17.87	32.35	23.95	92.94
25	7.33	0.0	10.61	305.85	17.78	31.66	23.93	93.83
27	7.19	-0.1	10.82	306.10	17.70	30.93	23.90	94.73
Mar. 1	7.04	-0.1	11.04	306.30	+17.64	-30.15	+23.86	95.62
3	6.91	0.2	11.26	306.46	17.59	29.33	23.82	96.52
5	6.77	0.3	11.49	306.57	17.55	28.47	23.77	97.41
7	6.64	0.3	11.71	306.64	17.53	27.55	23.72	98.31
9	6.51	0.4	11.94	306.65	17.52	26.59	23.66	99.21
11	6.39	-0.4	12.18	306.62	+17.53	-25.58	+23.59	100.11
13	6.27	0.5	12.41	306.54	17.55	24.51	23.52	101.01
15	6.15	0.6	12.65	306.41	17.59	23.40	23.44	101.92
17	6.04	0.6	12.88	306.22	17.65	22.23	23.35	102.83
19	5.93	0.7	13.11	305.99	17.72	21.01	23.26	103.73
21	5.83	-0.7	13.34	305.70	+17.81	-19.74	+23.16	104.64
23	5.73	0.8	13.57	305.37	17.91	18.42	23.06	105.55
25	5.64	0.8	13.79	304.98	18.03	17.05	22.94	106.47
27	5.55	0.9	14.01	304.54	18.17	15.63	22.83	107.38
29	5.47	0.9	14.22	304.06	18.32	14.16	22.70	108.30
31	5.40	-1.0	14.42	303.53	+18.49	-12.64	+22.57	109.22
Apr. 2	5.33	-1.1	14.60	302.95	+18.66	-11.08	+22.44	110.14

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^b UNIVERSAL TIME

Date	k	i	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Jan. 0	0.904	36.03	0.63	292.96	30.91	13.14	3.56	23 45.4	.. . .
2	.904	36.09	0.64	292.83	31.22	353.97	344.39	0 24.8	1 04.1
4	.904	36.14	0.65	292.70	31.53	334.82	325.25	1 43.5	2 22.8
6	.904	36.17	0.66	292.56	31.82	315.68	306.12	3 02.1	3 41.4
8	.904	36.20	0.67	292.42	32.10	296.56	287.01	4 20.7	4 59.9
10	0.903	36.20	0.68	292.27	32.37	277.46	267.92	5 39.2	6 18.4
12	.904	36.19	0.69	292.12	32.62	258.38	248.84	6 57.6	7 36.7
14	.904	36.16	0.70	291.97	32.86	239.31	229.79	8 15.9	8 55.0
16	.904	36.12	0.71	291.81	33.09	220.27	210.76	9 34.1	10 13.2
18	.904	36.06	0.72	291.64	33.31	201.25	191.74	10 52.2	11 31.3
20	0.905	35.98	0.73	291.48	33.52	182.24	172.75	12 10.3	12 49.3
22	.905	35.87	0.74	291.31	33.71	163.26	153.78	13 28.2	14 07.2
24	.906	35.75	0.74	291.14	33.89	144.31	134.84	14 46.1	15 25.0
26	.906	35.61	0.75	290.96	34.06	125.37	115.91	16 03.8	16 42.7
28	.907	35.45	0.76	290.79	34.22	106.46	97.02	17 21.5	18 00.3
30	0.908	35.26	0.76	290.61	34.37	87.58	78.14	18 39.0	19 17.7
Feb. 1	.909	35.05	0.77	290.43	34.51	68.72	59.30	19 56.4	20 35.1
3	.911	34.81	0.77	290.25	34.64	49.88	40.48	21 13.7	21 52.4
5	.912	34.55	0.77	290.07	34.76	31.08	21.69	22 30.9	23 09.5
7	.913	34.26	0.77	289.89	34.87	12.30	2.92	23 48.0	.. . .
9	0.915	33.94	0.77	289.71	34.98	353.56	344.19	0 26.5	1 04.9
11	.917	33.58	0.77	289.53	35.07	334.84	325.50	1 43.3	2 21.7
13	.918	33.20	0.77	289.34	35.15	316.16	306.83	3 00.0	3 38.3
15	.920	32.78	0.77	289.16	35.23	297.51	288.20	4 16.6	4 54.8
17	.922	32.33	0.76	288.99	35.30	278.89	269.60	5 33.0	6 11.2
19	0.925	31.84	0.75	288.81	35.36	260.32	251.04	6 49.3	7 27.4
21	.927	31.32	0.74	288.63	35.41	241.77	232.52	8 05.4	8 43.4
23	.930	30.75	0.73	288.46	35.46	223.27	214.03	9 21.3	9 59.2
25	.932	30.15	0.72	288.28	35.50	204.80	195.58	10 37.1	11 14.9
27	.935	29.50	0.70	288.11	35.53	186.38	177.18	11 52.7	12 30.4
Mar. 1	0.938	28.82	0.68	287.94	35.56	167.99	158.82	13 08.1	13 45.8
3	.941	28.08	0.66	287.76	35.58	149.65	140.50	14 23.3	15 00.9
5	.944	27.30	0.64	287.59	35.59	131.36	122.23	15 38.4	16 15.8
7	.948	26.47	0.61	287.42	35.60	113.11	104.00	16 53.2	17 30.5
9	.951	25.59	0.59	287.24	35.60	94.91	85.82	18 07.8	18 45.1
11	0.954	24.66	0.56	287.06	35.60	76.75	67.69	19 22.2	19 59.4
13	.958	23.68	0.52	286.87	35.59	58.65	49.61	20 36.4	21 13.5
15	.961	22.65	0.49	286.68	35.57	40.59	31.58	21 50.4	22 27.3
17	.965	21.56	0.45	286.47	35.55	22.59	13.60	23 04.2	23 41.0
19	.969	20.42	0.41	286.24	35.51	4.63	355.67	.. . .	0 17.7
21	0.972	19.23	0.37	285.99	35.47	346.73	337.79	0 54.4	1 31.1
23	.976	17.99	0.33	285.71	35.43	328.87	319.96	2 07.7	2 44.2
25	.979	16.70	0.29	285.39	35.37	311.06	302.18	3 20.7	3 57.1
27	.982	15.35	0.25	285.00	35.31	293.31	284.44	4 33.5	5 09.8
29	.985	13.96	0.21	284.54	35.23	275.59	266.75	5 46.1	6 22.4
31	0.988	12.52	0.17	283.95	35.15	257.93	249.11	6 58.6	7 34.7
Apr. 2	0.991	11.04	0.14	283.18	35.05	240.30	231.50	8 10.8	8 46.8

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
	m		"	°	°	°	°	°
Apr. 2	5.33	-1.1	14.60	302.95	+18.66	-11.08	+22.44	110.14
4	5.26	1.1	14.78	302.34	18.85	9.48	22.29	111.06
6	5.21	1.2	14.94	301.69	19.06	7.84	22.14	111.99
8	5.16	1.2	15.09	301.00	19.27	6.17	21.99	112.92
10	5.11	1.2	15.21	300.28	19.49	4.47	21.83	113.84
12	5.08	-1.3	15.32	299.54	+19.71	- 2.74	+21.66	114.78
14	5.05	1.3	15.41	298.79	19.94	- 1.00	21.49	115.71
16	5.02	1.3	15.48	298.02	20.17	+ 0.76	21.31	116.65
18	5.01	1.3	15.53	297.24	20.41	2.52	21.12	117.58
20	5.00	1.3	15.56	296.46	20.64	4.28	20.93	118.52
22	5.00	-1.3	15.57	295.70	+20.87	+ 6.04	+20.73	119.47
24	5.00	1.3	15.56	294.94	21.10	7.78	20.52	120.41
26	5.01	1.2	15.52	294.20	21.32	9.51	20.31	121.36
28	5.03	1.2	15.47	293.48	21.54	11.21	20.09	122.31
30	5.05	1.2	15.40	292.80	21.75	12.88	19.87	123.27
May 2	5.08	-1.2	15.31	292.14	+21.95	+14.52	+19.64	124.22
4	5.11	1.1	15.21	291.53	22.14	16.12	19.41	125.18
6	5.16	1.1	15.09	290.96	22.33	17.68	19.17	126.14
8	5.20	1.0	14.95	290.43	22.50	19.19	18.92	127.10
10	5.25	1.0	14.81	289.96	22.66	20.65	18.66	128.07
12	5.31	-1.0	14.65	289.53	+22.82	+22.06	+18.41	129.04
14	5.37	0.9	14.49	289.17	22.96	23.41	18.14	130.01
16	5.43	0.9	14.31	288.85	23.09	24.71	17.87	130.99
18	5.50	0.8	14.14	288.60	23.22	25.95	17.59	131.97
20	5.57	0.8	13.95	288.40	23.33	27.13	17.31	132.95
22	5.65	-0.8	13.76	288.26	+23.43	+28.25	+17.02	133.93
24	5.73	0.7	13.57	288.18	23.53	29.32	16.73	134.92
26	5.81	0.7	13.38	288.15	23.61	30.33	16.43	135.91
28	5.90	0.6	13.19	288.18	23.68	31.29	16.13	136.90
30	5.98	0.6	13.00	288.27	23.74	32.19	15.82	137.90
June 1	6.07	-0.5	12.81	288.41	+23.80	+33.04	+15.50	138.90
3	6.17	0.5	12.62	288.60	23.84	33.83	15.18	139.90
5	6.26	0.5	12.43	288.84	23.87	34.57	14.85	140.90
7	6.36	0.4	12.24	289.13	23.90	35.27	14.52	141.91
9	6.45	0.4	12.05	289.47	23.91	35.92	14.19	142.93
11	6.55	-0.3	11.87	289.85	+23.92	+36.51	+13.84	143.94
13	6.65	0.3	11.69	290.29	23.91	37.07	13.50	144.96
15	6.75	0.3	11.52	290.76	23.89	37.58	13.15	145.98
17	6.85	0.2	11.35	291.28	23.87	38.05	12.79	147.01
19	6.96	0.2	11.18	291.84	23.83	38.48	12.43	148.04
21	7.06	-0.2	11.01	292.43	+23.79	+38.87	+12.06	149.07
23	7.17	0.1	10.85	293.06	23.73	39.23	11.69	150.11
25	7.27	0.1	10.70	293.73	23.66	39.55	11.31	151.15
27	7.38	-0.1	10.55	294.43	23.58	39.84	10.93	152.19
29	7.48	0.0	10.40	295.16	23.50	40.10	10.55	153.24
July 1	7.59	0.0	10.25	295.92	+23.40	+40.33	+10.16	154.29
3	7.69	0.0	10.11	296.71	+23.28	+40.54	+ 9.76	155.34

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	k	i	Defect of Illumi- nation	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Follow- ing Date	Of Date	Of Follow- ing Date
		°	"	°	°	°	°	h m	h m
Apr. 2	0.991	11.04	0.14	283.18	35.05	240.30	231.50	8 10.8	8 46.8
4	.993	9.52	0.10	282.14	34.95	222.72	213.94	9 22.9	9 58.8
6	.995	7.96	0.07	280.66	34.83	205.17	196.40	10 34.8	11 10.7
8	.997	6.38	0.05	278.40	34.70	187.65	178.90	11 46.6	12 22.4
10	.998	4.79	0.03	274.53	34.57	170.16	161.42	12 58.2	13 34.0
12	0.999	3.22	0.01	266.71	34.42	152.69	143.97	14 09.8	14 45.6
14	1.000	1.80	0.00	245.20	34.26	135.24	126.52	15 21.4	15 57.1
16	1.000	1.34	0.00	182.12	34.10	117.80	109.08	16 32.8	17 08.6
18	1.000	2.46	0.01	141.17	33.93	100.36	91.65	17 44.3	18 20.1
20	0.999	4.02	0.02	128.60	33.75	82.93	74.20	18 55.8	19 31.6
22	0.998	5.65	0.04	123.19	33.57	65.48	56.75	20 07.4	20 43.1
24	.996	7.30	0.06	120.25	33.38	48.02	39.28	21 19.0	21 54.8
26	.994	8.94	0.09	118.43	33.20	30.54	21.79	22 30.7	23 06.6
28	.992	10.57	0.13	117.20	33.01	13.03	4.27	23 42.5	.. . . .
30	.989	12.18	0.17	116.32	32.83	355.50	346.72	0 18.5	0 54.5
May 2	0.986	13.76	0.22	115.66	32.66	337.93	329.13	1 30.5	2 06.6
4	.982	15.31	0.27	115.15	32.49	320.32	311.50	2 42.7	3 18.9
6	.979	16.82	0.32	114.75	32.33	302.67	293.82	3 55.1	4 31.4
8	.975	18.29	0.38	114.43	32.18	284.96	276.09	5 07.7	5 44.1
10	.971	19.71	0.43	114.16	32.04	267.21	258.31	6 20.6	6 57.1
12	0.967	21.09	0.49	113.94	31.92	249.40	240.48	7 33.6	8 10.3
14	.962	22.42	0.55	113.75	31.81	231.54	222.59	8 46.9	9 23.7
16	.958	23.70	0.60	113.59	31.72	213.62	204.64	10 00.5	10 37.4
18	.953	24.92	0.66	113.45	31.65	195.64	186.63	11 14.3	11 51.3
20	.949	26.10	0.71	113.32	31.59	177.61	168.57	12 28.4	13 05.5
22	0.945	27.22	0.76	113.21	31.55	159.51	150.44	13 42.7	14 19.9
24	.940	28.30	0.81	113.12	31.53	141.36	132.26	14 57.2	15 34.6
26	.936	29.32	0.86	113.03	31.52	123.15	114.02	16 12.1	16 49.5
28	.932	30.30	0.90	112.95	31.53	104.88	95.73	17 27.1	18 04.7
30	.928	31.23	0.94	112.87	31.57	86.56	77.38	18 42.4	19 20.1
June 1	0.923	32.11	0.98	112.80	31.61	68.19	58.98	19 57.9	20 35.7
3	.920	32.95	1.01	112.74	31.68	49.76	40.52	21 13.6	21 51.6
5	.916	33.74	1.05	112.67	31.76	31.28	22.02	22 29.6	23 07.7
7	.912	34.49	1.08	112.61	31.85	12.75	3.46	23 45.8	.. . . .
9	.909	35.20	1.10	112.55	31.96	354.17	344.86	0 24.0	1 02.2
11	0.905	35.87	1.13	112.49	32.08	335.54	326.21	1 40.4	2 18.8
13	.902	36.50	1.15	112.43	32.22	316.87	307.52	2 57.1	3 35.5
15	.899	37.09	1.17	112.37	32.36	298.15	288.78	4 14.0	4 52.5
17	.896	37.64	1.18	112.31	32.52	279.39	270.00	5 31.1	6 09.7
19	.893	38.16	1.19	112.24	32.69	260.59	251.18	6 48.3	7 27.0
21	0.890	38.65	1.21	112.17	32.86	241.76	232.33	8 05.7	8 44.4
23	.888	39.11	1.22	112.10	33.05	222.89	213.44	9 23.2	10 02.1
25	.886	39.54	1.22	112.02	33.23	203.98	194.51	10 40.9	11 19.8
27	.883	39.94	1.23	111.94	33.43	185.04	175.55	11 58.8	12 37.8
29	.881	40.31	1.23	111.86	33.63	166.06	156.57	13 16.8	13 55.8
July 1	0.879	40.65	1.24	111.77	33.83	147.06	137.55	14 34.9	15 14.0
3	0.878	40.97	1.24	111.68	34.03	128.03	118.50	15 53.1	16 32.3

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
	m		"	°	°	°	°	°
July 1	7.59	0.0	10.25	295.92	+23.40	+40.33	+10.16	154.29
3	7.69	0.0	10.11	296.71	23.28	40.54	9.76	155.34
5	7.80	+0.1	9.97	297.53	23.16	40.71	9.37	156.40
7	7.91	0.1	9.84	298.37	23.03	40.86	8.96	157.46
9	8.01	0.1	9.71	299.24	22.88	40.99	8.56	158.53
11	8.12	+0.2	9.58	300.14	+22.73	+41.09	+ 8.15	159.60
13	8.22	0.2	9.46	301.06	22.56	41.17	7.73	160.67
15	8.33	0.2	9.34	302.00	22.38	41.24	7.32	161.75
17	8.44	0.2	9.22	302.95	22.19	41.28	6.89	162.83
19	8.54	0.3	9.11	303.93	21.98	41.30	6.47	163.91
21	8.65	+0.3	9.00	304.93	+21.77	+41.31	+ 6.04	165.00
23	8.75	0.3	8.89	305.94	21.54	41.31	5.61	166.09
25	8.86	0.3	8.78	306.97	21.30	41.29	5.17	167.19
27	8.96	0.4	8.68	308.02	21.05	41.25	4.73	168.28
29	9.06	0.4	8.58	309.08	20.78	41.21	4.29	169.39
31	9.17	+0.4	8.49	310.15	+20.51	+41.15	+ 3.85	170.49
Aug. 2	9.27	0.4	8.39	311.24	20.22	41.09	3.40	171.61
4	9.37	0.4	8.30	312.33	19.92	41.01	2.95	172.72
6	9.47	0.5	8.21	313.44	19.61	40.92	2.50	173.84
8	9.57	0.5	8.12	314.56	19.28	40.83	2.05	174.96
10	9.68	+0.5	8.04	315.70	+18.95	+40.73	+ 1.59	176.09
12	9.78	0.5	7.96	316.84	18.60	40.62	1.13	177.22
14	9.88	0.5	7.88	317.99	18.24	40.50	0.67	178.35
16	9.97	0.6	7.80	319.15	17.87	40.38	+ 0.21	179.49
18	10.07	0.6	7.72	320.31	17.48	40.26	- 0.25	180.63
20	10.17	+0.6	7.65	321.49	+17.09	+40.13	- 0.72	181.77
22	10.27	0.6	7.57	322.67	16.68	40.00	1.19	182.92
24	10.37	0.6	7.50	323.85	16.27	39.87	1.65	184.07
26	10.46	0.6	7.43	325.05	15.84	39.73	2.12	185.23
28	10.56	0.7	7.37	326.24	15.40	39.60	2.59	186.39
30	10.65	+0.7	7.30	327.45	+14.95	+39.46	- 3.06	187.55
Sept. 1	10.75	0.7	7.24	328.66	14.49	39.32	3.53	188.72
3	10.84	0.7	7.17	329.87	14.02	39.18	4.00	189.89
5	10.94	0.7	7.11	331.09	13.54	39.03	4.47	191.06
7	11.03	0.7	7.05	332.32	13.05	38.89	4.94	192.24
9	11.12	+0.7	6.99	333.55	+12.55	+38.75	- 5.41	193.42
11	11.21	0.8	6.94	334.78	12.04	38.61	5.88	194.61
13	11.31	0.8	6.88	336.02	11.52	38.47	6.35	195.80
15	11.40	0.8	6.83	337.26	11.00	38.33	6.82	196.99
17	11.49	0.8	6.77	338.51	10.46	38.20	7.29	198.18
19	11.58	+0.8	6.72	339.76	+ 9.92	+38.06	- 7.75	199.38
21	11.67	0.8	6.67	341.01	9.37	37.93	8.22	200.58
23	11.76	0.8	6.62	342.27	8.81	37.80	8.68	201.79
25	11.84	0.8	6.57	343.52	8.24	37.67	9.14	202.99
27	11.93	0.9	6.52	344.79	7.67	37.54	9.59	204.21
29	12.02	+0.9	6.47	346.06	+ 7.09	+37.42	-10.05	205.42
Oct. 1	12.11	+0.9	6.42	347.33	+ 6.51	+37.29	-10.50	206.64

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
July	1	0.879	40.65	1.24	111.77	33.83	147.06	137.55	14 34.9
	3	.878	40.97	1.24	111.68	34.03	128.03	118.50	15 53.1
	5	.876	41.27	1.24	111.58	34.23	108.97	99.43	17 11.5
	7	.874	41.54	1.24	111.47	34.44	89.88	80.33	18 29.9
	9	.873	41.79	1.24	111.36	34.64	70.77	61.20	19 48.5
	11	0.871	42.02	1.23	111.24	34.84	51.63	42.06	21 07.2
	13	.870	42.23	1.23	111.11	35.04	32.47	22.88	22 26.0
	15	.869	42.42	1.22	110.97	35.24	13.29	3.69	23 44.8
	17	.868	42.59	1.22	110.83	35.43	354.09	344.48	0 24.3
	19	.867	42.75	1.21	110.68	35.61	334.87	325.25	1 43.3
	21	0.866	42.89	1.20	110.52	35.79	315.63	306.01	3 02.3
	23	.866	43.01	1.19	110.35	35.96	296.38	286.74	4 21.5
	25	.865	43.12	1.19	110.17	36.12	277.11	267.46	5 40.7
	27	.864	43.21	1.18	109.98	36.27	257.82	248.17	6 60.0
	29	.864	43.29	1.17	109.78	36.41	238.52	228.86	8 19.3
	31	0.864	43.35	1.16	109.58	36.54	219.21	209.54	9 38.7
Aug.	2	.863	43.40	1.15	109.36	36.66	199.88	190.21	10 58.2
	4	.863	43.44	1.14	109.13	36.77	180.54	170.87	12 17.7
	6	.863	43.47	1.13	108.89	36.86	161.19	151.51	13 37.2
	8	.863	43.48	1.11	108.64	36.94	141.83	132.14	14 56.8
	10	0.863	43.49	1.10	108.38	37.00	122.45	112.76	16 16.5
	12	.863	43.48	1.09	108.11	37.05	103.07	93.38	17 36.2
	14	.863	43.47	1.08	107.83	37.08	83.68	73.98	18 55.9
	16	.863	43.44	1.07	107.53	37.09	64.28	54.58	20 15.6
	18	.863	43.40	1.06	107.23	37.09	44.88	35.17	21 35.4
	20	0.864	43.36	1.04	106.91	37.07	25.46	15.75	22 55.2
	22	.864	43.31	1.03	106.58	37.03	6.04	356.33	0 15.1
	24	.864	43.25	1.02	106.24	36.98	346.62	336.90	0 55.0
	26	.865	43.18	1.01	105.89	36.90	327.18	317.47	2 14.9
	28	.865	43.10	0.99	105.52	36.80	307.75	298.02	3 34.8
	30	0.866	43.02	0.98	105.14	36.69	288.30	278.58	4 54.8
Sept.	1	.866	42.93	0.97	104.75	36.55	268.85	259.13	6 14.7
	3	.867	42.83	0.96	104.35	36.39	249.40	239.67	7 34.7
	5	.867	42.73	0.94	103.94	36.21	229.94	220.21	8 54.7
	7	.868	42.61	0.93	103.51	36.01	210.48	200.74	10 14.7
	9	0.869	42.49	0.92	103.07	35.79	191.01	181.27	11 34.8
	11	.869	42.37	0.91	102.62	35.54	171.54	161.80	12 54.8
	13	.870	42.24	0.89	102.16	35.27	152.06	142.32	14 14.9
	15	.871	42.10	0.88	101.69	34.99	132.58	122.84	15 35.0
	17	.872	41.96	0.87	101.21	34.68	113.10	103.35	16 55.1
	19	0.873	41.82	0.86	100.71	34.34	93.61	83.86	18 15.2
	21	.874	41.67	0.84	100.21	33.99	74.12	64.37	19 35.3
	23	.874	41.51	0.83	99.69	33.61	54.62	44.88	20 55.5
	25	.875	41.35	0.82	99.16	33.21	35.13	25.38	22 15.7
	27	.876	41.18	0.81	98.62	32.79	15.63	5.87	23 35.8
	29	0.877	41.01	0.79	98.08	32.34	356.12	346.37	0 15.9
Oct.	1	0.878	40.84	0.78	97.52	31.88	336.61	326.86	1 36.2

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date		Light-time	Stellar Magnitude	Diameter	A_E+180°	D_E	A_S-A_E	D_S	L_S
		m		"	°	°	°	°	°
Oct.	1	12.11	+0.9	6.42	347.33	+ 6.51	+37.29	-10.50	206.64
	3	12.20	0.9	6.38	348.60	5.91	37.17	10.95	207.86
	5	12.28	0.9	6.33	349.88	5.32	37.05	11.40	209.08
	7	12.37	0.9	6.29	351.16	4.71	36.94	11.84	210.31
	9	12.45	0.9	6.24	352.45	4.11	36.82	12.28	211.53
	11	12.54	+0.9	6.20	353.74	+ 3.49	+36.71	-12.71	212.77
	13	12.63	0.9	6.16	355.04	2.88	36.60	13.14	214.00
	15	12.71	0.9	6.12	356.34	2.25	36.50	13.56	215.24
	17	12.80	1.0	6.08	357.64	1.63	36.39	13.98	216.47
	19	12.88	1.0	6.04	358.95	1.00	36.29	14.40	217.71
	21	12.96	+1.0	6.00	0.27	+ 0.37	+36.19	-14.81	218.96
	23	13.05	1.0	5.96	1.59	- 0.26	36.09	15.21	220.20
	25	13.13	1.0	5.92	2.91	0.89	35.99	15.61	221.45
	27	13.22	1.0	5.89	4.24	1.53	35.90	16.00	222.70
	29	13.30	1.0	5.85	5.57	2.16	35.80	16.39	223.95
	Nov.	31	13.38	+1.0	5.81	6.91	- 2.80	+35.71	-16.77
2		13.47	1.0	5.78	8.26	3.43	35.61	17.14	226.46
4		13.55	1.0	5.74	9.62	4.07	35.52	17.50	227.72
6		13.63	1.0	5.71	10.98	4.71	35.43	17.86	228.98
8		13.71	1.0	5.67	12.34	5.34	35.33	18.21	230.24
10		13.80	+1.1	5.64	13.72	- 5.97	+35.24	-18.55	231.50
12		13.88	1.1	5.60	15.10	6.60	35.14	18.88	232.76
14		13.96	1.1	5.57	16.48	7.23	35.05	19.21	234.02
16		14.04	1.1	5.54	17.88	7.85	34.95	19.52	235.29
18		14.13	1.1	5.51	19.28	8.47	34.85	19.83	236.55
20		14.21	+1.1	5.47	20.69	- 9.09	+34.75	-20.13	237.82
22		14.29	1.1	5.44	22.11	9.70	34.65	20.41	239.09
24		14.37	1.1	5.41	23.54	10.31	34.55	20.69	240.36
26		14.45	1.1	5.38	24.97	10.91	34.44	20.96	241.63
28		14.54	1.1	5.35	26.42	11.50	34.33	21.22	242.89
Dec.		30	14.62	+1.1	5.32	27.87	-12.09	+34.21	-21.46
	2	14.70	1.1	5.29	29.33	12.67	34.09	21.70	245.43
	4	14.78	1.2	5.26	30.80	13.24	33.96	21.92	246.70
	6	14.87	1.2	5.23	32.28	13.81	33.83	22.14	247.97
	8	14.95	1.2	5.20	33.77	14.36	33.70	22.34	249.24
	10	15.03	+1.2	5.18	35.27	-14.91	+33.56	-22.53	250.51
	12	15.11	1.2	5.15	36.78	15.45	33.41	22.71	251.78
	14	15.19	1.2	5.12	38.29	15.97	33.26	22.88	253.05
	16	15.27	1.2	5.09	39.82	16.49	33.10	23.04	254.32
	18	15.36	1.2	5.06	41.36	16.99	32.93	23.19	255.59
	20	15.44	+1.2	5.04	42.90	-17.48	+32.76	-23.32	256.85
	22	15.52	1.2	5.01	44.46	17.96	32.58	23.44	258.12
	24	15.60	1.2	4.98	46.02	18.43	32.39	23.55	259.38
	26	15.69	1.2	4.96	47.60	18.89	32.19	23.65	260.65
	28	15.77	1.2	4.93	49.18	19.33	31.98	23.73	261.91
	30	15.85	+1.3	4.91	50.77	-19.75	+31.76	-23.81	263.17
32	15.93	+1.3	4.88	52.37	-20.17	+31.54	-23.87	264.43	

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>k</i>	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		Universal Time of Transit of Zero Meridian	
				Defect	Axis	Of Date	Of Following Date	Of Date	Of Following Date
		°	"	°	°	°	°	h m	h m
Oct. 1	0.878	40.84	0.78	97.52	31.88	336.61	326.86	1 36.2	2 16.3
3	.879	40.66	0.77	96.96	31.39	317.10	307.34	2 56.4	3 36.5
5	.880	40.48	0.76	96.38	30.88	297.58	287.82	4 16.6	4 56.7
7	.881	40.29	0.75	95.80	30.35	278.06	268.30	5 36.9	6 17.0
9	.882	40.10	0.73	95.21	29.80	258.54	248.78	6 57.2	7 37.3
11	0.884	39.90	0.72	94.61	29.23	239.01	229.24	8 17.5	8 57.6
13	.885	39.70	0.71	94.01	28.64	219.48	209.71	9 37.8	10 17.9
15	.886	39.50	0.70	93.40	28.03	199.94	190.17	10 58.1	11 38.3
17	.887	39.29	0.69	92.79	27.41	180.40	170.63	12 18.4	12 58.6
19	.888	39.08	0.68	92.17	26.76	160.85	151.08	13 38.8	14 19.0
21	0.889	38.87	0.66	91.55	26.09	141.30	131.53	14 59.2	15 39.4
23	.890	38.65	0.65	90.92	25.41	121.75	111.97	16 19.6	16 59.8
25	.892	38.43	0.64	90.29	24.71	102.19	92.41	17 40.1	18 20.3
27	.893	38.21	0.63	89.66	24.00	82.62	72.84	19 00.5	19 40.7
29	.894	37.98	0.62	89.03	23.27	63.05	53.26	20 21.0	21 01.2
31	0.895	37.75	0.61	88.40	22.52	43.47	33.68	21 41.5	22 21.8
Nov. 2	.897	37.52	0.60	87.77	21.76	23.89	14.10	23 02.0	23 42.3
4	.898	37.28	0.59	87.13	20.98	4.30	354.50	.. ..	0 22.6
6	.899	37.04	0.58	86.50	20.19	344.70	334.90	1 02.9	1 43.2
8	.900	36.80	0.57	85.87	19.39	325.10	315.30	2 23.5	3 03.8
10	0.902	36.56	0.55	85.25	18.57	305.49	295.68	3 44.1	4 24.5
12	.903	36.31	0.54	84.63	17.75	285.87	276.06	5 04.8	5 45.2
14	.904	36.06	0.53	84.01	16.91	266.25	256.44	6 25.5	7 05.9
16	.905	35.81	0.52	83.40	16.06	246.62	236.80	7 46.2	8 26.6
18	.907	35.55	0.51	82.79	15.20	226.98	217.16	9 07.0	9 47.4
20	0.908	35.30	0.50	82.19	14.34	207.33	197.51	10 27.8	11 08.2
22	.909	35.04	0.49	81.59	13.46	187.68	177.85	11 48.6	12 29.1
24	.911	34.78	0.48	81.00	12.58	168.02	158.18	13 09.5	13 49.9
26	.912	34.51	0.47	80.42	11.69	148.35	138.51	14 30.4	15 10.9
28	.913	34.25	0.46	79.85	10.79	128.67	118.82	15 51.3	16 31.8
30	0.915	33.98	0.45	79.29	9.89	108.98	99.13	17 12.3	17 52.8
Dec. 2	.916	33.71	0.44	78.74	8.97	89.28	79.43	18 33.4	19 13.9
4	.917	33.43	0.44	78.20	8.06	69.57	59.72	19 54.4	20 35.0
6	.919	33.16	0.43	77.66	7.14	49.86	39.99	21 15.5	21 56.1
8	.920	32.88	0.42	77.14	6.21	30.13	20.26	22 36.7	23 17.2
10	0.921	32.60	0.41	76.63	5.28	10.40	0.53	23 57.8	.. ..
12	.923	32.32	0.40	76.14	4.35	350.65	340.78	0 38.4	1 19.1
14	.924	32.04	0.39	75.65	3.41	330.90	321.02	1 59.7	2 40.3
16	.925	31.75	0.38	75.18	2.48	311.14	301.25	3 21.0	4 01.6
18	.926	31.46	0.37	74.72	1.54	291.36	281.47	4 42.3	5 23.0
20	0.928	31.18	0.36	74.27	0.60	271.58	261.69	6 03.7	6 44.4
22	.929	30.89	0.36	73.83	359.65	251.79	241.89	7 25.1	8 05.8
24	.930	30.59	0.35	73.41	358.71	231.99	222.09	8 46.5	9 27.3
26	.932	30.30	0.34	73.00	357.77	212.18	202.27	10 08.0	10 48.8
28	.933	30.00	0.33	72.61	356.82	192.36	182.45	11 29.5	12 10.3
30	0.934	29.71	0.32	72.23	355.88	172.53	162.62	12 51.1	13 31.9
32	0.936	29.41	0.31	71.86	354.94	152.70	142.78	14 12.7	14 53.5

JUPITER, 1967
EPHEMERIS FOR PHYSICAL OBSERVATIONS
FOR 0^h UNIVERSAL TIME

Date	Light-time	Stellar Magnitude	Diameter		A_E+180°	D_E	A_S+180°	D_S
			Equatorial	Polar				
	m		"	"	°	°	°	°
Jan. - 2	36.12	-2.1	45.30	42.28	345.89 ⁻⁴⁶	+0.76	341.28	+0.99
2	35.93	2.1	45.55	42.51	345.43 ⁴⁹	0.77	341.60	0.97
6	35.77	2.2	45.75	42.70	344.94 ⁵⁰	0.77	341.93	0.95
10	35.65	2.2	45.91	42.85	344.44 ⁵³	0.78	342.25	0.94
14	35.57	2.2	46.01	42.94	343.91 ⁵³	0.78	342.58	0.92
18	35.53	-2.2	46.05	42.98	343.38 ⁻⁵⁴	+0.79	342.90	+0.90
22	35.54	2.2	46.04	42.97	342.84 ⁵³	0.80	343.23	0.89
26	35.59	2.2	45.98	42.92	342.31 ⁵³	0.80	343.55	0.87
30	35.68	2.2	45.86	42.81	341.78 ⁵¹	0.81	343.88	0.85
Feb. 3	35.81	2.1	45.70	42.65	341.27 ⁴⁸	0.82	344.20	0.84
7	35.99	-2.1	45.48	42.45	340.79 ⁻⁴⁶	+0.83	344.52	+0.82
11	36.20	2.1	45.21	42.20	340.33 ⁴³	0.84	344.85	0.80
15	36.45	2.1	44.90	41.91	339.90 ³⁹	0.84	345.17	0.79
19	36.73	2.1	44.56	41.59	339.51 ³⁵	0.85	345.49	0.77
23	37.05	2.1	44.17	41.23	339.16 ³¹	0.86	345.82	0.75
27	37.40	-2.1	43.76	40.84	338.85 ⁻²⁶	+0.86	346.14	+0.74
Mar. 3	37.77	2.0	43.32	40.44	338.59 ²¹	0.87	346.46	0.72
7	38.18	2.0	42.86	40.01	338.38 ¹⁶	0.87	346.79	0.70
11	38.61	2.0	42.39	39.56	338.22 ¹¹	0.88	347.11	0.69
15	39.06	2.0	41.90	39.11	338.11 ⁵	0.88	347.43	0.67
19	39.53	-1.9	41.40	38.64	338.06 ⁻¹	+0.88	347.75	+0.65
23	40.01	1.9	40.90	38.17	338.05 ⁺⁵	0.88	348.07	0.63
27	40.51	1.9	40.39	37.70	338.10 ⁹	0.88	348.40	0.62
31	41.03	1.8	39.89	37.23	338.19 ¹⁵	0.87	348.72	0.60
Apr. 4	41.55	1.8	39.39	36.76	338.34 ¹⁹	0.87	349.04	0.58
8	42.07	-1.8	38.90	36.30	338.53 ⁺²⁵	+0.87	349.36	+0.57
12	42.61	1.8	38.41	35.85	338.78 ²⁸	0.86	349.68	0.55
16	43.14	1.7	37.94	35.41	339.06 ³³	0.85	350.00	0.53
20	43.67	1.7	37.47	34.97	339.39 ³⁸	0.84	350.32	0.52
24	44.20	1.7	37.02	34.55	339.77 ⁴¹	0.83	350.64	0.50
28	44.73	-1.7	36.59	34.15	340.18 ⁺⁴⁵	+0.82	350.96	+0.48
May 2	45.25	1.6	36.16	33.75	340.63 ⁴⁹	0.81	351.28	0.47
6	45.77	1.6	35.76	33.37	341.12 ⁵²	0.79	351.60	0.45
10	46.27	1.6	35.37	33.01	341.64 ⁵⁶	0.78	351.92	0.43
14	46.77	1.6	34.99	32.66	342.20 ⁵⁹	0.76	352.24	0.41
18	47.25	-1.5	34.64	32.33	342.79 ⁺⁶¹	+0.75	352.56	+0.40
22	47.71	1.5	34.30	32.01	343.40 ⁶⁵	0.73	352.88	0.38
26	48.17	1.5	33.98	31.71	344.05 ⁶⁷	0.71	353.20	0.36
30	48.60	1.5	33.67	31.43	344.72 ⁶⁹	0.69	353.52	0.35
June 3	49.02	1.4	33.38	31.16	345.41 ⁷¹	0.67	353.84	0.33
7	49.42	-1.4	33.11	30.90	346.12 ⁺⁷⁴	+0.64	354.16	+0.31
11	49.80	1.4	32.86	30.67	346.86 ⁷⁵	0.62	354.48	0.30
15	50.16	1.4	32.62	30.45	347.61 ⁷⁷	0.59	354.79	0.28
19	50.50	1.4	32.40	30.24	348.38 ⁷⁹	0.57	355.11	0.26
23	50.82	1.4	32.20	30.05	349.17 ⁸¹	0.54	355.43	0.24
27	51.11	-1.4	32.02	29.88	349.98 ⁺⁸¹	+0.51	355.75	+0.23
July 1	51.38	-1.3	31.85	29.72	350.79	+0.48	356.07	+0.21

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date	<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		
			Defect	Axis	System I	System II	Correction for Phase
	°	"	°	°	°	°	°
Jan. - 2	4.62	0.07	282.07	14.84	59.59	227.12	+0.09
2	3.83 ⁻⁷⁹	.05	281.64	14.67	331.77	108.78	.06
6	3.02 ⁸¹	.03	281.05	14.49	243.95	350.44	.04
10	2.19 ⁸³	.02	280.13	14.30	156.13	232.10	.02
14	1.34 ⁸⁵	.01	278.27	14.10	68.30	113.76	+ .01
18	0.49 ⁻⁸⁵	0.00	270.56	13.90	340.46	355.39	0.00
22	0.40 ^{..}	.00	116.64	13.69	252.59	237.00	.00
26	1.25 ⁺⁸⁵	.01	106.46	13.49	164.70	118.59	- .01
30	2.09 ⁸⁴	.02	104.38	13.28	76.76	0.14	.02
Feb. 3	2.92 ⁸³	.03	103.39	13.08	348.79	241.65	.04
7	3.74 ⁸²	0.05	102.76	12.89	260.77	123.11	-0.06
11	4.52 ⁺⁷⁸	.07	102.30	12.71	172.71	4.52	.09
15	5.27 ⁷⁵	.09	101.93	12.54	84.58	245.88	.12
19	5.98 ⁷¹	.12	101.63	12.38	356.40	127.18	.16
23	6.66 ⁶⁸	.15	101.37	12.24	268.15	8.42	.19
27	7.28 ⁶²	0.18	101.15	12.12	179.85	249.59	-0.23
Mar. 3	7.87 ⁺⁵⁹	.20	100.97	12.01	91.48	130.70	.27
7	8.40 ⁵³	.23	100.81	11.93	3.04	11.75	.31
11	8.88 ⁴⁸	.25	100.69	11.86	274.54	252.73	.34
15	9.31 ⁴³	.28	100.58	11.82	185.97	133.65	.38
19	9.69 ³⁸	0.30	100.51	11.79	97.34	14.50	-0.41
23	10.02 ⁺³³	.31	100.46	11.79	8.65	255.29	.44
27	10.30 ²⁸	.33	100.43	11.81	279.90	136.02	.46
31	10.52 ²²	.34	100.42	11.85	191.10	16.70	.48
Apr. 4	10.70 ¹⁸	.34	100.44	11.91	102.23	257.32	.50
8	10.82 ¹²	0.35	100.47	11.99	13.32	137.88	-0.51
12	10.90 ^{+ 8}	.35	100.53	12.09	284.35	18.40	.52
16	10.94 ^{+ 4}	.34	100.60	12.20	195.34	258.87	.52
20	10.92 ^{- 2}	.34	100.69	12.34	106.28	139.30	.52
24	10.87 ⁵	.33	100.79	12.49	17.18	19.68	.51
28	10.78 ⁹	0.32	100.91	12.65	288.05	260.03	-0.51
May 2	10.65 ⁻¹³	.31	101.04	12.83	198.88	140.34	.49
6	10.48 ¹⁷	.30	101.19	13.03	109.68	20.62	.48
10	10.28 ²⁰	.28	101.34	13.23	20.45	260.87	.46
14	10.04 ²⁴	.27	101.51	13.45	291.19	141.10	.44
18	9.77 ²⁷	0.25	101.68	13.68	201.91	21.30	-0.42
22	9.47 ⁻³⁰	.23	101.86	13.92	112.61	261.48	.39
26	9.15 ³²	.22	102.04	14.16	23.29	141.65	.36
30	8.80 ³⁵	.20	102.23	14.41	293.95	21.80	.34
June 3	8.43 ³⁷	.18	102.42	14.67	204.61	261.93	.31
7	8.03 ⁴⁰	0.16	102.62	14.94	115.25	142.05	-0.28
11	7.61 ⁻⁴²	.14	102.81	15.21	25.88	22.17	.25
15	7.18 ⁴³	.13	102.99	15.48	296.50	262.27	.22
19	6.72 ⁴⁶	.11	103.17	15.76	207.13	142.38	.20
23	6.25 ⁴⁷	.10	103.35	16.04	117.74	22.48	.17
27	5.77 ⁴⁸	0.08	103.50	16.32	28.36	262.58	-0.15
July 1	5.27 ⁻⁵⁰	0.07	103.64	16.60	298.98	142.68	-0.12

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date		Light-time	Stellar Magnitude	Diameter		A_E+180°	D_E	A_S+180°	D_S
				Equatorial	Polar				
		m		"	"	°	°	°	°
July	1	51.38	-1.3	31.85	29.72	350.79	+0.48	356.07	+0.21
	5	51.63	1.3	31.70	29.58	351.62 ⁺⁸³	0.45	356.38	0.19
	9	51.85	1.3	31.56	29.46	352.46 ⁸⁴	0.42	356.70	0.18
	13	52.05	1.3	31.44	29.35	353.31 ⁸⁵	0.39	357.02	0.16
	17	52.22	1.3	31.34	29.25	354.16 ⁸⁵	0.36	357.34	0.14
	21	52.36	-1.3	31.25	29.17	355.03 ⁸⁷	+0.33	357.65	+0.13
	25	52.48	1.3	31.18	29.10	355.89 ⁺⁸⁶	0.29	357.97	0.11
	29	52.57	1.3	31.13	29.05	356.77 ⁸⁸	0.26	358.29	0.09
Aug.	2	52.64	1.3	31.09	29.02	357.64 ⁸⁷	0.23	358.60	0.07
	6	52.68	1.3	31.07	29.00	358.52 ⁸⁸	0.19	358.92	0.06
	10	52.69	-1.3	31.06	28.99	359.40 ⁺⁸⁸	+0.15	359.24	+0.04
	14	52.67	1.3	31.07	29.00	0.28 ⁸⁷	0.12	359.55	0.02
	18	52.63	1.3	31.10	29.02	1.15 ⁸⁸	0.08	359.87	+0.01
	22	52.55	1.3	31.14	29.06	2.03 ⁸⁷	0.04	0.18	-0.01
	26	52.46	1.3	31.20	29.12	2.90 ⁸⁶	+0.01	0.50	0.03
	30	52.33	-1.3	31.27	29.19	3.76 ⁺⁸⁶	-0.03	0.81	-0.04
Sept.	3	52.18	1.3	31.36	29.27	4.62 ⁸⁴	0.07	1.13	0.06
	7	52.00	1.3	31.47	29.37	5.46 ⁸⁴	0.11	1.45	0.08
	11	51.80	1.3	31.60	29.49	6.30 ⁸³	0.14	1.76	0.09
	15	51.57	1.3	31.74	29.62	7.13 ⁸²	0.18	2.08	0.11
	19	51.31	-1.3	31.89	29.77	7.95 ⁺⁸⁰	-0.22	2.39	-0.13
	23	51.03	1.4	32.07	29.93	8.75 ⁷⁸	0.26	2.71	0.15
	27	50.73	1.4	32.26	30.11	9.53 ⁷⁷	0.30	3.02	0.16
Oct.	1	50.40	1.4	32.47	30.30	10.30 ⁷⁵	0.34	3.33	0.18
	5	50.05	1.4	32.70	30.52	11.05 ⁷³	0.37	3.65	0.20
	9	49.68	-1.4	32.94	30.74	11.78 ⁺⁷¹	-0.41	3.96	-0.21
	13	49.29	1.4	33.20	30.99	12.49 ⁶⁹	0.45	4.28	0.23
	17	48.88	1.4	33.48	31.25	13.18 ⁶⁶	0.49	4.59	0.25
	21	48.45	1.5	33.78	31.52	13.84 ⁶³	0.52	4.90	0.26
	25	48.01	1.5	34.09	31.82	14.47 ⁶⁰	0.56	5.22	0.28
	29	47.54	-1.5	34.42	32.13	15.07 ⁺⁵⁸	-0.59	5.53	-0.30
Nov.	2	47.07	1.5	34.77	32.45	15.65 ⁵⁴	0.63	5.85	0.31
	6	46.58	1.5	35.13	32.79	16.19 ⁵⁰	0.66	6.16	0.33
	10	46.08	1.6	35.51	33.15	16.69 ⁴⁷	0.70	6.47	0.35
	14	45.57	1.6	35.91	33.52	17.16 ⁴³	0.73	6.78	0.36
	18	45.06	-1.6	36.32	33.90	17.59 ⁺³⁸	-0.76	7.10	-0.38
	22	44.54	1.6	36.75	34.30	17.97 ³⁵	0.79	7.41	0.40
	26	44.01	1.7	37.18	34.70	18.32 ³⁰	0.82	7.72	0.41
	30	43.49	1.7	37.63	35.12	18.62 ²⁵	0.85	8.03	0.43
Dec.	4	42.96	1.7	38.09	35.55	18.87 ²¹	0.87	8.35	0.45
	8	42.44	-1.7	38.56	35.99	19.08 ⁺¹⁶	-0.90	8.66	-0.46
	12	41.93	1.8	39.03	36.43	19.24 ¹¹	0.92	8.97	0.48
	16	41.42	1.8	39.51	36.88	19.35 ⁵	0.94	9.28	0.50
	20	40.92	1.8	39.99	37.32	19.40 ⁺¹	0.96	9.60	0.51
	24	40.44	1.8	40.46	37.77	19.41 ⁻⁵	0.98	9.91	0.53
	28	39.98	-1.9	40.94	38.21	19.36 ⁻¹⁰	-1.00	10.22	-0.55
	32	39.53	-1.9	41.40	38.64	19.26	-1.01	10.53	-0.56

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date		<i>i</i>	Defect of Illumination	Position Angle of		Central Meridian		
				Defect	Axis	System I	System II	Correction for Phase
		°	"	°	°	°	°	°
July	1	5.27	0.07	103.64	16.60	298.98	142.68	-0.12
	5	4.76 ⁻⁵¹	.05	103.75	16.89	209.60	22.78	.10
	9	4.24 ⁵²	.04	103.83	17.17	120.23	262.89	.08
	13	3.71 ⁵³	.03	103.84	17.45	30.86	143.00	.06
	17	3.17 ⁵⁴	.02	103.78	17.73	301.50	23.12	.04
		⁵⁵						
	21	2.62	0.02	103.57	18.00	212.15	263.25	-0.03
	25	2.07 ⁻⁵⁵	.01	103.11	18.28	122.81	143.39	.02
	29	1.52 ⁵⁵	.01	102.13	18.55	33.48	23.54	- .01
Aug.	2	0.96 ⁵⁶	.00	99.71	18.81	304.16	263.71	.00
	6	0.41 ⁻⁵⁵	.00	90.00	19.08	214.86	143.89	.00
		..						
	10	0.21	0.00	322.66	19.33	125.58	24.08	0.00
	14	0.74 ⁺⁵³	.00	297.01	19.59	36.31	264.29	.00
	18	1.30 ⁵⁶	.00	293.20	19.83	307.06	144.53	+ .01
	22	1.85 ⁵⁵	.01	291.81	20.07	217.83	24.78	.02
	26	2.41 ⁵⁶	.01	291.16	20.31	128.62	265.05	.03
		⁵⁴						
	30	2.95	0.02	290.83	20.54	39.44	145.34	+0.04
Sept.	3	3.50 ⁺⁵⁵	.03	290.67	20.76	310.27	25.65	.05
	7	4.03 ⁵³	.04	290.59	20.97	221.13	265.99	.07
	11	4.55 ⁵²	.05	290.58	21.18	132.02	146.36	.09
	15	5.07 ⁵²	.06	290.60	21.38	42.93	26.75	.11
		⁵⁰						
	19	5.57	0.08	290.64	21.57	313.87	267.17	+0.14
	23	6.05 ⁺⁴⁸	.09	290.70	21.76	224.84	147.62	.16
	27	6.52 ⁴⁷	.10	290.77	21.94	135.84	28.09	.19
Oct.	1	6.98 ⁴⁶	.12	290.85	22.11	46.87	268.60	.21
	5	7.42 ⁴⁴	.14	290.92	22.27	317.93	149.14	.24
		⁴¹						
	9	7.83	0.15	291.00	22.42	229.03	29.71	+0.27
	13	8.23 ⁺⁴⁰	.17	291.07	22.57	140.16	270.32	.29
	17	8.60 ³⁷	.19	291.14	22.70	51.32	150.97	.32
	21	8.94 ³⁴	.21	291.21	22.83	322.52	31.64	.35
	25	9.26 ³²	.22	291.27	22.95	233.76	272.36	.37
		²⁹						
	29	9.55	0.24	291.33	23.07	145.04	153.12	+0.40
Nov.	2	9.81 ⁺²⁶	.25	291.38	23.17	56.36	33.91	.42
	6	10.04 ²³	.27	291.42	23.27	327.72	274.75	.44
	10	10.23 ¹⁹	.28	291.45	23.36	239.12	155.62	.46
	14	10.38 ¹⁵	.29	291.48	23.44	150.56	36.54	.47
		¹²						
	18	10.50	0.30	291.50	23.51	62.05	277.51	+0.48
	22	10.58 ^{+ 8}	.31	291.51	23.58	333.57	158.51	.49
	26	10.61 ^{+ 3}	.32	291.50	23.63	245.15	39.57	.49
	30	10.60 ^{- 1}	.32	291.49	23.68	156.77	280.66	.49
Dec.	4	10.54 ⁶	.32	291.47	23.72	68.43	161.81	.48
		¹¹						
	8	10.43	0.32	291.43	23.76	340.14	42.99	+0.47
	12	10.28 ⁻¹⁵	.31	291.39	23.78	251.90	284.23	.46
	16	10.07 ²¹	.30	291.32	23.80	163.70	165.51	.44
	20	9.82 ²⁵	.29	291.25	23.81	75.55	46.83	.42
	24	9.51 ³¹	.28	291.16	23.81	347.44	288.20	.39
		³⁶						
	28	9.15	0.26	291.04	23.81	259.37	169.61	+0.36
	32	8.74 ⁻⁴¹	0.24	290.91	23.79	171.34	51.05	+0.33

EPHEMERIS FOR PHYSICAL OBSERVATIONS

LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM I

Day (0 ^h U.T.)	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	°	°	°	°	°	°	°	°	°	°	°	°
1	173.8	32.8	135.4	348.4	40.7	249.0	298.9	146.5	354.9	47.1	258.9	315.2
2	331.8	190.8	293.3	146.2	198.4	46.6	96.5	304.2	152.6	204.9	56.8	113.1
3	129.9	348.8	91.2	304.0	356.1	204.3	254.2	101.8	310.3	2.6	214.6	271.0
4	287.9	146.7	249.1	101.7	153.8	2.0	51.8	259.5	108.0	160.4	12.5	68.9
5	85.9	304.7	47.0	259.5	311.5	159.6	209.5	57.2	265.8	318.2	170.3	226.8
6	244.0	102.7	204.9	57.3	109.2	317.3	7.2	214.9	63.5	115.9	328.2	24.8
7	42.0	260.7	2.7	215.0	266.9	115.0	164.8	12.5	221.2	273.7	126.0	182.7
8	200.1	58.7	160.6	12.8	64.6	272.6	322.5	170.2	18.9	71.5	283.9	340.6
9	358.1	216.7	318.5	170.6	222.3	70.3	120.2	327.9	176.7	229.3	81.7	138.6
10	156.2	14.6	116.3	328.3	20.0	228.0	277.8	125.6	334.4	27.1	239.6	296.5
11	314.2	172.6	274.2	126.1	177.7	25.6	75.5	283.3	132.1	184.9	37.4	94.4
12	112.2	330.6	72.1	283.8	335.4	183.3	233.1	80.9	289.8	342.7	195.3	252.4
13	270.3	128.5	229.9	81.6	133.1	341.0	30.8	238.6	87.6	140.5	353.2	50.3
14	68.3	286.5	27.8	239.3	290.7	138.6	188.5	36.3	245.3	298.2	151.0	208.2
15	226.3	84.5	185.6	37.1	88.4	296.3	346.1	194.0	43.0	96.0	308.9	6.2
16	24.4	242.4	343.4	194.8	246.1	93.9	143.8	351.7	200.8	253.8	106.8	164.1
17	182.4	40.4	141.3	352.6	43.8	251.6	301.5	149.4	358.5	51.6	264.6	322.1
18	340.5	198.3	299.1	150.3	201.5	49.3	99.1	307.1	156.3	209.4	62.5	120.1
19	138.5	356.2	96.9	308.0	359.2	206.9	256.8	104.7	314.0	7.3	220.4	278.0
20	296.5	154.2	254.8	105.8	156.9	4.6	54.5	262.5	111.8	165.1	18.3	76.0
21	94.6	312.1	52.6	263.5	314.5	162.3	212.1	60.2	269.5	322.9	176.2	233.9
22	252.6	110.0	210.4	61.2	112.2	319.9	9.8	217.8	67.2	120.7	334.1	31.9
23	50.6	268.0	8.2	218.9	269.9	117.6	167.5	15.5	225.0	278.5	132.0	189.9
24	208.6	65.9	166.0	16.7	67.6	275.2	325.1	173.2	22.8	76.3	289.8	347.8
25	6.7	223.8	323.8	174.4	225.2	72.9	122.8	330.9	180.5	234.1	87.7	145.8
26	164.7	21.7	121.6	332.1	22.9	230.6	280.5	128.6	338.3	32.0	245.6	303.8
27	322.7	179.6	279.4	129.8	180.6	28.2	78.1	286.4	136.0	189.8	43.5	101.8
28	120.7	337.5	77.2	287.5	338.3	185.9	235.8	84.1	293.8	347.6	201.4	259.7
29	278.7		235.0	85.3	135.9	343.5	33.5	241.8	91.5	145.4	359.3	57.7
30	76.7		32.8	243.0	293.6	141.2	191.1	39.5	249.3	303.3	157.3	215.7
31	234.8		190.6		91.3		348.8	197.2		101.1		13.7

MOTION OF THE CENTRAL MERIDIAN

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h
m	°	°	°	°	°	°	°	°	°	°	°	°
0	0.0	36.6	73.2	109.7	146.3	182.9	219.5	256.1	292.7	329.2	5.8	42.4
5	3.0	39.6	76.2	112.8	149.4	186.0	222.5	259.1	295.7	332.3	8.9	45.4
10	6.1	42.7	79.3	115.8	152.4	189.0	225.6	262.2	298.7	335.3	11.9	48.5
15	9.1	45.7	82.3	118.9	155.5	192.1	228.6	265.2	301.8	338.4	15.0	51.5
20	12.2	48.8	85.4	121.9	158.5	195.1	231.7	268.3	304.8	341.4	18.0	54.6
25	15.2	51.8	88.4	125.0	161.6	198.1	234.7	271.3	307.9	344.5	21.1	57.6
30	18.3	54.9	91.5	128.0	164.6	201.2	237.8	274.4	310.9	347.5	24.1	60.7
35	21.3	57.9	94.5	131.1	167.7	204.2	240.8	277.4	314.0	350.6	27.2	63.7
40	24.4	61.0	97.6	134.1	170.7	207.3	243.9	280.5	317.0	353.6	30.2	66.8
45	27.4	64.0	100.6	137.2	173.8	210.3	246.9	283.5	320.1	356.7	33.2	69.8
50	30.5	67.1	103.6	140.2	176.8	213.4	250.0	286.6	323.1	359.7	36.3	72.9
55	33.5	70.1	106.7	143.3	179.9	216.4	253.0	289.6	326.2	2.8	39.3	75.9
60	36.6	73.2	109.7	146.3	182.9	219.5	256.1	292.7	329.2	5.8	42.4	79.0

EPHEMERIS FOR PHYSICAL OBSERVATIONS

LONGITUDE OF CENTRAL MERIDIAN OF ILLUMINATED DISK

SYSTEM II

Day (0 ^h U.T.)	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	°	°	°	°	°	°	°	°	°	°	°	°
1	318.4	300.9	189.9	166.4	349.8	321.5	142.6	113.7	85.5	268.8	244.1	71.4
2	108.8	91.2	340.2	316.5	139.8	111.6	292.6	263.7	235.6	59.0	34.3	221.7
3	259.3	241.6	130.4	106.7	289.9	261.6	82.6	53.7	25.7	209.1	184.5	12.0
4	49.7	32.0	280.7	256.8	80.0	51.7	232.7	203.8	175.8	359.2	334.8	162.3
5	200.1	182.3	70.9	47.0	230.1	201.7	22.7	353.8	325.9	149.4	125.0	312.6
6	350.5	332.7	221.2	197.1	20.1	351.7	172.7	143.9	116.0	299.5	275.2	102.9
7	140.9	123.0	11.4	347.2	170.2	141.8	322.7	293.9	266.1	89.7	65.4	253.2
8	291.3	273.4	161.7	137.4	320.3	291.8	112.8	84.0	56.2	239.8	215.6	43.5
9	81.7	63.7	311.9	287.5	110.4	81.8	262.8	234.0	206.3	30.0	5.9	193.8
10	232.1	214.1	102.2	77.6	260.4	231.9	52.8	24.1	356.3	180.1	156.1	344.1
11	22.5	4.4	252.4	227.8	50.5	21.9	202.9	174.1	146.4	330.3	306.3	134.4
12	172.9	154.8	42.6	17.9	200.5	171.9	352.9	324.2	296.5	120.5	96.5	284.7
13	323.4	305.1	192.8	168.0	350.6	322.0	142.9	114.2	86.7	270.6	246.8	75.0
14	113.8	95.4	343.1	318.1	140.7	112.0	293.0	264.3	236.8	60.8	37.0	225.3
15	264.2	245.8	133.3	108.2	290.7	262.0	83.0	54.3	26.9	210.9	187.3	15.6
16	54.6	36.1	283.5	258.3	80.8	52.1	233.0	204.4	177.0	1.1	337.5	165.9
17	205.0	186.4	73.7	48.5	230.8	202.1	23.1	354.5	327.1	151.3	127.7	316.3
18	355.4	336.7	223.9	198.6	20.9	352.1	173.1	144.5	117.2	301.5	278.0	106.6
19	145.8	127.0	14.1	348.7	170.9	142.2	323.1	294.6	267.3	91.6	68.2	256.9
20	296.2	277.3	164.3	138.8	321.0	292.2	113.2	84.7	57.4	241.8	218.5	47.2
21	86.6	67.6	314.5	288.9	111.0	82.2	263.2	234.7	207.5	32.0	8.7	197.6
22	237.0	217.9	104.7	79.0	261.1	232.3	53.3	24.8	357.7	182.2	159.0	347.9
23	27.4	8.2	254.9	229.1	51.1	22.3	203.3	174.9	147.8	332.4	309.3	138.3
24	177.8	158.5	45.0	19.2	201.2	172.3	353.3	324.9	297.9	122.5	99.5	288.6
25	328.2	308.8	195.2	169.3	351.2	322.4	143.4	115.0	88.0	272.7	249.8	78.9
26	118.6	99.1	345.4	319.3	141.3	112.4	293.4	265.1	238.2	62.9	40.1	229.3
27	269.0	249.4	135.6	109.4	291.3	262.4	83.5	55.1	28.3	213.1	190.3	19.6
28	59.4	39.6	285.7	259.5	81.4	52.5	233.5	205.2	178.4	3.3	340.6	170.0
29	209.7	189.9	75.9	49.6	231.4	202.5	23.5	355.3	328.5	153.5	130.9	320.3
30	0.1		226.1	199.7	21.5	352.5	173.6	145.4	118.7	303.7	281.2	110.7
31	150.5		16.2		171.5		323.6	295.5		93.9		261.0

MOTION OF THE CENTRAL MERIDIAN

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h
m	°	°	°	°	°	°	°	°	°	°	°	°
0	0.0	36.3	72.5	108.8	145.1	181.3	217.6	253.8	290.1	326.4	2.6	38.9
5	3.0	39.3	75.5	111.8	148.1	184.3	220.6	256.9	293.1	329.4	5.7	41.9
10	6.0	42.3	78.6	114.8	151.1	187.4	223.6	259.9	296.1	332.4	8.7	44.9
15	9.1	45.3	81.6	117.9	154.1	190.4	226.6	262.9	299.2	335.4	11.7	48.0
20	12.1	48.4	84.6	120.9	157.1	193.4	229.7	265.9	302.2	338.5	14.7	51.0
25	15.1	51.4	87.6	123.9	160.2	196.4	232.7	268.9	305.2	341.5	17.7	54.0
30	18.1	54.4	90.7	126.9	163.2	199.4	235.7	272.0	308.2	344.5	20.8	57.0
35	21.2	57.4	93.7	129.9	166.2	202.5	238.7	275.0	311.3	347.5	23.8	60.0
40	24.2	60.4	96.7	133.0	169.2	205.5	241.8	278.0	314.3	350.5	26.8	63.1
45	27.2	63.5	99.7	136.0	172.2	208.5	244.8	281.0	317.3	353.6	29.8	66.1
50	30.2	66.5	102.7	139.0	175.3	211.5	247.8	284.1	320.3	356.6	32.8	69.1
55	33.2	69.5	105.8	142.0	178.3	214.6	250.8	287.1	323.3	359.6	35.9	72.1
60	36.3	72.5	108.8	145.1	181.3	217.6	253.8	290.1	326.4	2.6	38.9	75.1

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

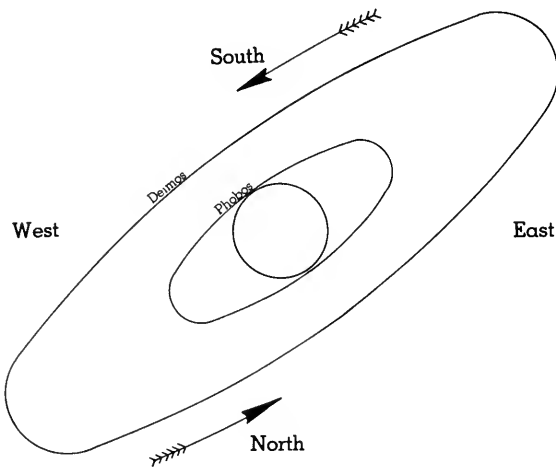
Date	Light-time	Stellar Magnitude	Diameter		i	Defect of Illumination	Position Angle of Defect
			Equatorial	Polar			
	m		"	"	°	"	°
Jan. - 2	80.64	+1.4	17.17	15.37	5.77	0.04	67.14
2	81.17	1.4	17.06	15.27	5.67	.04	67.29
6	81.69	1.4	16.95	15.17	5.54	.04	67.44
10	82.20	1.4	16.85	15.08	5.39	.04	67.60
14	82.70	1.4	16.75	14.99	5.22	.03	67.76
18	83.17	+1.4	16.65	14.90	5.03	0.03	67.94
22	83.63	1.4	16.56	14.82	4.82	.03	68.13
26	84.07	1.4	16.47	14.74	4.59	.03	68.34
30	84.48	1.3	16.39	14.67	4.34	.02	68.57
Feb. 3	84.87	1.3	16.32	14.60	4.07	.02	68.83
7	85.24	+1.3	16.25	14.54	3.79	0.02	69.12
11	85.58	1.3	16.18	14.48	3.50	.02	69.47
15	85.89	1.3	16.12	14.43	3.19	.01	69.88
19	86.17	+1.3	16.07	14.38	2.88	0.01	70.38
..
Apr. 24	86.27	+1.1	16.05	14.37	2.75	0.01	242.49
28	86.00	1.1	16.10	14.41	3.07	.01	243.05
May 2	85.71	1.1	16.16	14.46	3.39	.01	243.52
6	85.39	1.1	16.22	14.51	3.69	.02	243.92
10	85.04	1.1	16.28	14.57	3.98	.02	244.26
14	84.67	+1.1	16.36	14.64	4.25	0.02	244.56
18	84.27	1.1	16.43	14.71	4.51	.03	244.83
22	83.86	1.1	16.52	14.78	4.76	.03	245.07
26	83.42	1.1	16.60	14.86	4.99	.03	245.30
30	82.96	1.1	16.69	14.94	5.20	.03	245.51
June 3	82.48	+1.1	16.79	15.03	5.39	0.04	245.71
7	81.99	1.1	16.89	15.12	5.57	.04	245.90
11	81.48	1.0	17.00	15.21	5.72	.04	246.08
15	80.96	1.0	17.11	15.31	5.85	.04	246.26
19	80.43	1.0	17.22	15.41	5.96	.05	246.43
23	79.89	+1.0	17.33	15.51	6.05	0.05	246.60
27	79.35	1.0	17.45	15.62	6.11	.05	246.76
July 1	78.80	1.0	17.58	15.73	6.15	.05	246.93
5	78.24	1.0	17.70	15.84	6.16	.05	247.09
9	77.69	1.0	17.83	15.95	6.15	.05	247.26
13	77.14	+0.9	17.95	16.06	6.11	0.05	247.42
17	76.60	0.9	18.08	16.18	6.04	.05	247.60
21	76.06	0.9	18.21	16.29	5.95	.05	247.78
25	75.53	0.9	18.33	16.41	5.83	.05	247.96
29	75.02	+0.9	18.46	16.52	5.68	0.05	248.16

EPHEMERIS FOR PHYSICAL OBSERVATIONS

FOR 0^h UNIVERSAL TIME

Date		Light-time	Stellar Magnitude	Diameter		<i>i</i>	Defect of Illumination	Position Angle of Defect
				Equatorial	Polar			
		m		"	"	°	"	°
July	29	75.02	+0.9	18.46	16.52	5.68	0.05	248.16
Aug.	2	74.52	0.8	18.58	16.63	5.50	.04	248.37
	6	74.03	0.8	18.71	16.74	5.30	.04	248.60
	10	73.57	0.8	18.82	16.85	5.07	.04	248.85
	14	73.12	0.8	18.94	16.95	4.82	.03	249.12
	18	72.70	+0.7	19.05	17.05	4.54	0.03	249.43
	22	72.31	0.7	19.15	17.14	4.23	.03	249.79
	26	71.94	0.7	19.25	17.23	3.91	.02	250.21
	30	71.61	0.7	19.34	17.31	3.56	.02	250.71
Sept.	3	71.30	0.7	19.42	17.38	3.19	.01	251.34
	7	71.03	+0.6	19.50	17.45	2.81	0.01	252.13
	11	70.80	0.6	19.56	17.51	2.41	.01	253.20
	15	70.60	0.6	19.62	17.55	1.99	.01	254.71
	19	70.44	0.6	19.66	17.59	1.57	.00	257.03
	23	70.32	0.6	19.69	17.62	1.14	.00	261.10
	27	70.24	+0.6	19.72	17.64	0.72	0.00	270.00
Oct.	1	70.20	0.6	19.73	17.65	0.36	.00	299.73
	5	70.20	0.5	19.73	17.65	0.37	.00	16.26
	9	70.24	0.6	19.72	17.64	0.74	.00	44.31
	13	70.32	0.6	19.69	17.62	1.16	.00	52.88
	17	70.44	+0.6	19.66	17.59	1.59	0.00	56.85
	21	70.60	0.7	19.61	17.55	2.01	.01	59.14
	25	70.80	0.7	19.56	17.50	2.42	.01	60.63
	29	71.04	0.7	19.49	17.44	2.82	.01	61.69
Nov.	2	71.32	0.7	19.42	17.38	3.21	.02	62.48
	6	71.63	+0.8	19.33	17.30	3.57	0.02	63.11
	10	71.97	0.8	19.24	17.22	3.91	.02	63.62
	14	72.34	0.8	19.14	17.13	4.24	.03	64.05
	18	72.74	0.8	19.04	17.04	4.53	.03	64.41
	22	73.17	0.9	18.93	16.94	4.80	.03	64.73
	26	73.62	+0.9	18.81	16.83	5.05	0.04	65.02
	30	74.10	0.9	18.69	16.73	5.27	.04	65.28
Dec.	4	74.59	0.9	18.57	16.62	5.46	.04	65.51
	8	75.10	1.0	18.44	16.50	5.62	.04	65.73
	12	75.62	1.0	18.31	16.39	5.75	.05	65.93
	16	76.16	+1.0	18.19	16.27	5.86	0.05	66.13
	20	76.70	1.0	18.06	16.16	5.93	.05	66.31
	24	77.24	1.0	17.93	16.04	5.97	.05	66.49
	28	77.80	1.0	17.80	15.93	5.99	.05	66.67
	32	78.35	+1.1	17.68	15.82	5.98	0.05	66.85

APPARENT ORBITS OF THE SATELLITES AT DATE OF OPPOSITION,
APRIL 15



NAME		SIDEREAL PERIOD		
I	Phobos	h	m	s
		7	39	13.85
II	Deimos	30	17	54.87

DEIMOS

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

d	h	d	h	d	h	d	h	d	h
Mar. 22	12.7	Mar. 31	08.6	Apr. 10	10.7	Apr. 20	12.8	Apr. 30	14.9
23	19.0	Apr. 1	14.9	11	17.0	21	19.0	May 1	21.2
25	01.3	2	21.1	12	23.3	23	01.3	3	03.4
26	07.5	4	03.4	14	05.5	24	07.6	4	09.7
		5	09.7	15	11.8	25	13.8	5	16.0
27	13.8	6	15.9	16	18.1	26	20.1	6	22.2
28	20.1	7	22.2	18	00.3	28	02.4	8	04.5
30	02.3	9	04.5	19	06.5	29	08.6	..	..

DEIMOS

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1
h m		°	h m		°	h m		°	h m		°
0 00	1.000	126.0	8 00	0.322	231.9	16 00	0.986	309.2	24 00	0.398	77.1
0 40	0.991	128.5	8 40	0.377	252.6	16 40	0.956	311.8	24 40	0.485	89.9
1 20	0.966	131.0	9 20	0.460	266.8	17 20	0.909	314.6	25 20	0.580	98.6
2 00	0.924	133.8	10 00	0.554	276.5	18 00	0.848	317.8	26 00	0.673	104.9
2 40	0.866	136.9	10 40	0.648	283.4	18 40	0.774	321.5	26 40	0.760	109.8
3 20	0.796	140.4	11 20	0.737	288.5	19 20	0.689	326.1	27 20	0.836	113.6
4 00	0.713	144.8	12 00	0.816	292.6	20 00	0.596	332.1	28 00	0.900	116.9
4 40	0.622	150.3	12 40	0.884	296.0	20 40	0.501	340.4	28 40	0.949	119.8
5 20	0.527	157.8	13 20	0.937	298.9	21 20	0.412	352.3	29 20	0.982	122.4
6 00	0.436	168.5	14 00	0.974	301.7	22 00	0.342	10.0	30 00	0.998	124.9
6 40	0.358	184.5	14 40	0.995	304.2	22 40	0.311	33.7	30 40	0.997	127.4
7 20	0.315	206.8	15 20	0.999	306.7	23 20	0.333	58.2			

Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2
	"	°		"	°		"	°		"	°
..	...	..	Apr. 3	50.8	+1.0	Apr. 16	53.6	+0.3	Apr. 29	53.4	-0.7
Mar. 22	46.5	+1.3	4	51.1	1.0	17	53.6	0.2	30	53.3	0.8
23	46.9	1.3	5	51.4	0.9	18	53.7	0.1	May 1	53.1	0.9
24	47.3	1.3	6	51.7	0.9	19	53.8	+0.1	2	53.0	0.9
25	47.7	1.3	7	51.9	0.8	20	53.8	0.0	3	52.8	1.0
26	48.1	+1.3	8	52.2	+0.8	21	53.8	-0.1	4	52.6	-1.1
27	48.5	1.2	9	52.4	0.7	22	53.8	0.2	5	52.4	1.1
28	48.8	1.2	10	52.6	0.7	23	53.8	0.2	6	52.2	1.2
29	49.2	1.2	11	52.8	0.6	24	53.8	0.3	7	52.0	1.3
30	49.5	1.2	12	53.0	0.6	25	53.8	0.4	8	51.7	1.3
31	49.9	+1.1	13	53.2	+0.5	26	53.7	-0.5	9	51.5	-1.4
Apr. 1	50.2	1.1	14	53.3	0.4	27	53.6	0.5	10	51.2	-1.5
2	50.5	+1.1	15	53.4	+0.4	28	53.5	-0.6	..	...	..

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

	d	h		d	h		d	h		d	h			
	Apr.	1	06.6	Apr.	10	20.1	Apr.	20	09.7	Apr.	29	23.2
Mar.	23	00.7		1	14.2		11	03.8		20	17.3		30	06.9
	23	08.3		1	21.9		11	11.4		21	01.0		30	14.5
	23	16.0		2	05.5		11	19.1		21	08.6		30	22.2
	23	23.6		2	13.2		12	02.8		21	16.3	May	1	05.8
	24	07.3		2	20.9		12	10.4		21	23.9		1	13.5
	24	14.9		3	04.5		12	18.0		22	07.6		1	21.1
	24	22.6		3	12.1		13	01.7		22	15.2		2	04.8
	25	06.2		3	19.8		13	09.3		22	22.9		2	12.4
	25	13.9		4	03.5		13	17.0		23	06.5		2	20.1
	25	21.5		4	11.1		14	00.6		23	14.2		3	03.7
26	05.2		4	18.8		14	08.3		23	21.8		3	11.4	
26	12.8		5	02.4		14	15.9		24	05.5		3	19.0	
26	20.5		5	10.1		14	23.6		24	13.1		4	02.7	
27	04.2		5	17.7		15	07.3		24	20.8		4	10.3	
27	11.8		6	01.4		15	14.9		25	04.4		4	18.0	
27	19.5		6	09.0		15	22.6		25	12.1		5	01.6	
28	03.1		6	16.7		16	06.2		25	19.7		5	09.3	
28	10.8		7	00.3		16	13.8		26	03.4		5	16.9	
28	18.4		7	08.0		16	21.5		26	11.0		6	00.6	
29	02.1		7	15.6		17	05.2		26	18.7		6	08.3	
29	09.7		7	23.3		17	12.8		27	02.4		6	15.9	
29	17.4		8	06.9		17	20.5		27	10.0		6	23.5	
30	01.0		8	14.6		18	04.1		27	17.6		7	07.2	
30	08.7		8	22.2		18	11.8		28	01.3		7	14.9	
30	16.3		9	05.9		18	19.4		28	09.0		7	22.5	
31	00.0		9	13.5		19	03.1		28	16.6		8	06.2	
31	07.6		9	21.2		19	10.7		29	00.3		8	13.8	
31	15.3		10	04.8		19	18.4		29	07.9		8	21.5	
31	23.0		10	12.5		20	02.0		29	15.6		...	...

PHOBOS

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1
h m		°	h m		°	h m		°	h m		°
0 00	1.000	126.0	2 00	0.370	227.0	4 00	0.991	309.0	6 00	0.414	66.7
0 10	0.992	128.9	2 10	0.412	246.1	4 10	0.967	312.0	6 10	0.485	81.0
0 20	0.968	131.8	2 20	0.481	260.6	4 20	0.927	315.1	6 20	0.568	91.4
0 30	0.928	135.0	2 30	0.565	271.1	4 30	0.872	318.7	6 30	0.655	99.1
0 40	0.875	138.5	2 40	0.651	278.9	4 40	0.806	322.7	6 40	0.738	105.0
0 50	0.808	142.6	2 50	0.735	284.8	4 50	0.729	327.6	6 50	0.815	109.8
1 00	0.732	147.4	3 00	0.811	289.6	5 00	0.645	333.7	7 00	0.879	113.8
1 10	0.648	153.4	3 10	0.877	293.6	5 10	0.558	342.0	7 10	0.932	117.2
1 20	0.561	161.2	3 20	0.930	297.1	5 20	0.476	352.4	7 20	0.970	120.4
1 30	0.479	171.9	3 30	0.969	300.3	5 30	0.408	7.3	7 30	0.993	123.3
1 40	0.410	186.6	3 40	0.993	303.2	5 40	0.369	26.6	7 40	1.000	126.2
1 50	0.369	205.8	3 50	1.000	306.1	5 50	0.372	47.8			

Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2
"	"	°	"	"	°	"	"	°	"	"	°
Mar. 22	18.6	+1.4	Apr. 3	20.3	+1.0	Apr. 16	21.4	+0.2	Apr. 29	21.3	-1.1
23	18.8	1.4	4	20.4	0.9	17	21.4	+0.1	30	21.3	1.2
24	18.9	1.3	5	20.5	0.9	18	21.5	0.0	May 1	21.2	1.3
25	19.1	1.3	6	20.7	0.8	19	21.5	-0.1	2	21.2	1.4
			7	20.8	0.7	20	21.5	0.3	3	21.1	1.4
26	19.2	+1.3	8	20.9	+0.7	21	21.5	-0.4	4	21.0	-1.5
27	19.4	1.3	9	20.9	0.6	22	21.5	0.5	5	20.9	1.6
28	19.5	1.2	10	21.0	0.6	23	21.5	0.5	6	20.9	1.7
29	19.7	1.2	11	21.1	0.5	24	21.5	0.6	7	20.8	1.7
30	19.8	1.2	12	21.2	0.5	25	21.5	0.7	8	20.7	1.8
31	19.9	+1.1	13	21.2	+0.4	26	21.5	-0.8	9	20.6	-1.9
Apr. 1	20.0	1.1	14	21.3	0.4	27	21.4	0.9	10	20.5	-2.0
2	20.2	+1.0	15	21.4	+0.3	28	21.4	-1.0	..	..	..

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

Jupiter is in opposition January 20, but at this date the Earth is very near the planes of the orbits of the satellites, and hence the apparent orbits approximate straight lines.

NAME		MEAN SYNODIC PERIOD					NAME	SIDEREAL PERIOD
		d	h	m	s	d		d
V		0	11	57	27.619	= 0.498 236 33	X	253
I	Io	1	18	28	35.946	= 1.769 860 49	XII	631
II	Europa	3	13	17	53.736	= 3.554 094 17	XI	692
III	Ganymede	7	03	59	35.856	= 7.166 387 22	VIII	735
IV	Callisto	16	18	05	06.916	= 16.753 552 27	IX	758
VI						266.00		
VII						276.67		

SATELLITE V

UNIVERSAL TIME OF EVERY TWENTIETH GREATEST ELONGATION

Eastern Elongation					Western Elongation									
	d	h		d	h		d	h		d	h			
Jan.	0	07.4	Mar.	30	23.3	Jan.	0	13.3	Mar.	31	05.3			
	10	06.4		Apr.	9		22.5	10		12.4	Apr.	10	04.5	
	20	05.5			19		21.7			20		11.5	20	03.6
	30	04.6			29		20.8			30		10.6	30	02.8
Feb.	9	03.7	May	9	20.0	Feb.	9	09.7	May	10	02.0			
	19	02.8		19	19.2		19	08.8		20	01.2			
Mar.	1	01.9		29	18.4	Mar.	1	07.9		30	00.4			
	11	01.0	June	8	17.6		11	07.0	June	8	23.6			
	21	00.2		..	..		21	06.2		..	..	

MULTIPLES OF THE MEAN SYNODIC PERIOD

	d	h		d	h		d	h		d	h				
1	.	0	12.0	6	.	2	23.7	11	.	5	11.5	16	.	7	23.3
2	.	0	23.9	7	.	3	11.7	12	.	5	23.5	17	.	8	11.3
3	.	1	11.9	8	.	3	23.7	13	.	6	11.4	18	.	8	23.2
4	.	1	23.8	9	.	4	11.6	14	.	6	23.4	19	.	9	11.2
5	.	2	11.8	10	.	4	23.6	15	.	7	11.4	20	.	9	23.2

DIFFERENTIAL COORDINATES OF SATELLITE VI FOR 0^h U.T.

Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$	Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$	Date	$\alpha_{VI}-\alpha_{Jup.}$	$\delta_{VI}-\delta_{Jup.}$
Jan. -2	^m ^s -2 43	['] - 4.9	Apr. 8	^m ^s +4 00	['] +20.1	Sept. 27	^m ^s -1 41	['] +10.2
2	2 26	3.4	12	3 59	19.6	Oct. 1	1 31	11.5
6	2 06	1.9	16	3 56	18.9	5	1 20	12.7
10	1 45	- 0.3	20	3 51	18.0	9	1 08	13.7
14	1 22	+ 1.3	24	3 46	17.0	13	0 56	14.8
18	-0 58	+ 3.0	28	+3 39	+15.9	17	-0 43	+15.7
22	0 33	4.6	May 2	3 31	14.7	21	0 30	16.5
26	-0 08	6.2	6	3 21	13.4	25	0 16	17.2
30	+0 17	7.8	10	3 11	12.1	29	-0 02	17.8
Feb. 3	0 42	9.4	14	3 00	10.6	Nov. 2	+0 12	18.3
7	+1 06	+10.9	18	+2 47	+ 9.1	6	+0 26	+18.6
11	1 29	12.3	22	2 34	7.5	10	0 41	18.8
15	1 51	13.7	26	2 19	5.8	14	0 56	18.9
19	2 11	15.0	30	2 04	4.2	18	1 11	18.9
23	2 30	16.2	June 3	1 48	2.5	22	1 27	18.7
27	+2 47	+17.2	7	+1 31	+ 0.8	26	+1 42	+18.4
Mar. 3	3 03	18.2	11	1 14	- 0.8	30	1 57	17.9
7	3 16	19.0	15	0 56	2.4	Dec. 4	2 12	17.3
11	3 28	19.7	19	0 38	3.9	8	2 27	16.5
15	3 38	20.2	23	0 19	5.3	12	2 41	15.5
19	+3 46	+20.6	27	+0 01	- 6.5	16	-2 55	+14.5
23	3 52	20.9	July 1	-0 18	- 7.6	20	3 08	13.2
27	3 56	20.9	Sept 19	-2 00	+ 7.5	24	3 21	11.9
31	3 59	20.8	23	-1 51	+ 8.9	28	3 32	10.4
Apr. 4	+4 01	+20.6				32	+3 43	+ 8.8

DIFFERENTIAL COORDINATES OF SATELLITE VII FOR 0^h U.T.

Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$	Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$	Date	$\alpha_{VII}-\alpha_{Jup.}$	$\delta_{VII}-\delta_{Jup.}$
Jan. -2	^m ^s -4 26	['] -20.4	Apr. 8	^m ^s +3 05	['] + 7.1	Sept. 27	^m ^s -3 17	['] -8.6
2	4 13	21.5	12	3 00	9.0	Oct. 1	3 12	8.6
6	3 58	22.4	16	2 52	10.7	5	3 05	8.6
10	3 40	23.2	20	2 42	12.1	9	2 58	8.4
14	3 21	23.8	24	2 30	13.3	13	2 50	8.2
18	-2 59	-24.1	28	+2 15	+14.2	17	-2 41	-7.9
22	2 36	24.3	May 2	2 00	14.8	21	2 30	7.6
26	2 11	24.2	6	1 43	15.2	25	2 19	7.2
30	1 46	23.9	10	1 26	15.4	29	2 06	6.8
Feb. 3	1 20	23.4	14	1 08	15.3	Nov. 2	1 52	6.3
7	-0 53	-22.6	18	+0 50	+15.1	6	-1 38	-5.8
11	0 27	21.7	22	0 33	14.7	10	1 22	5.2
15	-0 01	20.5	26	+0 15	14.2	14	1 04	4.6
19	+0 25	19.2	30	-0 02	13.5	18	0 46	4.0
23	0 49	17.6	June 3	0 19	12.8	22	0 27	3.3
27	+1 13	-15.8	7	-0 36	+11.9	26	-0 06	-2.6
Mar. 3	1 35	13.8	11	0 52	11.0	30	+0 15	1.8
7	1 55	11.7	15	1 07	10.0	Dec. 4	0 37	1.0
11	2 13	9.5	19	1 21	9.0	8	0 59	-0.2
15	2 28	7.1	23	1 35	7.9	12	1 21	+0.6
19	+2 42	- 4.6	27	-1 48	+ 6.8	16	+1 42	+1.4
23	2 52	- 2.1	July 1	-2 00	+ 5.8	20	2 02	2.2
27	3 00	+ 0.3	Sept. 19	-3 24	- 8.4	24	2 21	2.9
31	3 05	2.7	23	-3 21	- 8.6	28	2 38	3.6
Apr. 4	+3 06	+ 5.0				32	+2 52	+4.3

UNIVERSAL TIME OF SUPERIOR GEOCENTRIC CONJUNCTION

SATELLITE I

Jan.	d	h	m	Mar.	d	h	m	June	d	h	m	Oct.	d	h	m
	0	03	11		22	11	32		10	03	24		15	15	28
	1	21	37		24	06	00		11	21	55		17	09	58
	3	16	03		26	00	28		13	16	25		19	04	27
	5	10	29		27	18	56		15	10	55		20	22	56
	7	04	55		29	13	24		17	05	25		22	17	26
	8	23	21		31	07	52		18	23	55		24	11	55
	10	17	47	Apr.	2	02	20		20	18	25		26	06	24
	12	12	13		3	20	49		22	12	55		28	00	53
	14	06	39		5	15	17		24	07	25		29	19	23
	16	01	05		7	09	46		26	01	55		31	13	52
	17	19	31		9	04	14		27	20	26	Nov.	2	08	21
	19	13	57		10	22	43		29	14	56		4	02	50
	21	08	23		12	17	12	July	1	09	26		5	21	19
	23	02	49		14	11	40		3	03	56		7	15	48
	24	21	15		16	06	08		4	22	26		9	10	16
	26	15	40		18	00	38		6	16	57		11	04	45
	28	10	07		19	19	07		8	11	27		12	23	14
	30	04	33		21	13	36		..	..	..		14	17	43
Feb.	31	22	59		23	08	04	Aug.	27	01	33		16	12	11
	2	17	25		25	02	34		28	20	03		18	06	40
	4	11	51		26	21	04		30	14	33		20	01	08
	6	06	17		28	15	32	Sept.	1	09	03		21	19	37
	8	00	44		30	10	01		3	03	33		23	14	05
	9	19	09	May	2	04	31		4	22	03		25	08	34
	11	13	36		3	23	00		6	16	33		27	03	02
	13	08	03		5	17	29		8	11	03		28	21	30
	15	02	29		7	11	59		10	05	33	Dec.	30	15	59
	16	20	55		9	06	28		12	00	03		2	10	27
	18	15	22		11	00	58		13	18	33		4	04	55
	20	09	49		12	19	27		15	13	03		5	23	23
	22	04	15		14	13	57		17	07	33		7	17	51
	23	22	42		16	08	27		19	02	03		9	12	19
	25	17	09		18	02	56		20	20	33		11	06	46
	27	11	36		19	21	26		22	15	03		13	01	14
Mar.	1	06	03		21	15	56		24	09	33		14	19	42
	3	00	30		23	10	25		26	04	02		16	14	09
	4	18	57		25	04	55		27	22	32		18	08	37
	6	13	24		26	23	25		29	17	02		20	03	04
	8	07	51		28	17	55	Oct.	1	11	32		21	21	32
	10	02	19		30	12	25		3	06	01		23	15	59
	11	20	46	June	1	06	55		5	00	31		25	10	26
	13	15	13		3	01	25		6	19	01		27	04	54
	15	09	41		4	19	55		8	13	30		28	23	21
	17	04	09		6	14	24		10	08	00		30	17	48
	18	22	36		8	08	55		12	02	29		32	12	15
	20	17	04						13	20	59				

UNIVERSAL TIME OF SUPERIOR GEOCENTRIC CONJUNCTION

SATELLITE II

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	0	22	18	Mar.	23	12	38	June	13	07	08	Oct.	15	20	36
	4	11	25		27	01	52		16	20	32		19	09	58
	8	00	32		30	15	07		20	09	56		22	23	20
	11	13	38	Apr.	3	04	22		23	23	20		26	12	42
	15	02	45		6	17	38		27	12	45		30	02	03
								July	1	02	10	Nov.	2	15	24
	18	15	51		10	06	54		4	15	34		6	04	44
	22	04	58		13	20	12		8	05	00		9	18	04
	25	18	04		17	09	29		..	..	..		13	07	24
	29	07	11		20	22	47	Aug.	27	00	56		16	20	43
Feb.	1	20	17		24	12	06								
	5	09	25		28	01	25		30	14	21		20	10	01
	8	22	32	May	1	14	44	Sept.	3	03	47		23	23	19
	12	11	40		5	04	04		6	17	12		27	12	37
	16	00	48		8	17	25		10	06	37	Dec.	1	01	54
	19	13	56		12	06	45		13	20	01		4	15	10
	23	03	05		15	20	07		17	09	27		8	04	26
	26	16	15		19	09	28		20	22	51		11	17	41
Mar.	2	05	25		22	22	50		24	12	15		15	06	56
	5	18	36		26	12	12		28	01	39		18	20	10
	9	07	47		30	01	35	Oct.	1	15	03		22	09	24
	12	20	59	June	2	14	58		5	04	26		25	22	36
	16	10	11		6	04	21		8	17	50		29	11	49
	19	23	24		9	17	44		12	07	13				

SATELLITE III

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	4	07	26	Mar.	31	00	45	June	17	22	29	Oct.	18	01	26
	11	10	43	Apr.	7	04	37		25	02	53		25	05	41
	18	13	59		14	08	33	July	2	07	17	Nov.	1	09	53
	25	17	14		21	12	34		..	..	..		8	14	02
Feb.	1	20	31		28	16	39	Aug.	28	18	52		15	18	08
	8	23	48	May	5	20	47	Sept.	4	23	18		22	22	10
	16	03	09		13	00	58		12	03	43		30	02	07
	23	06	34		20	05	11		19	08	07	Dec.	7	06	00
Mar.	2	10	03		27	09	27		26	12	30		14	09	49
	9	13	37	June	3	13	46	Oct.	3	16	51		21	13	34
	16	17	15		10	18	06		10	21	10		28	17	14
	23	20	58												

SATELLITE IV

	d	h	m		d	h	m		d	h	m		d	h	m
Jan.	7	00	09	Mar.	31	03	28	June	23	02	42	Oct.	19	01	53
	23	14	13	Apr.	16	21	06		..	..	..	Nov.	4	21	13
Feb.	9	04	24	May	3	15	35	Aug.	29	13	12		21	15	52
	25	19	10		20	10	47	Sept.	15	09	44	Dec.	8	09	41
Mar.	14	10	49	June	6	06	32	Oct.	2	06	00		25	02	31

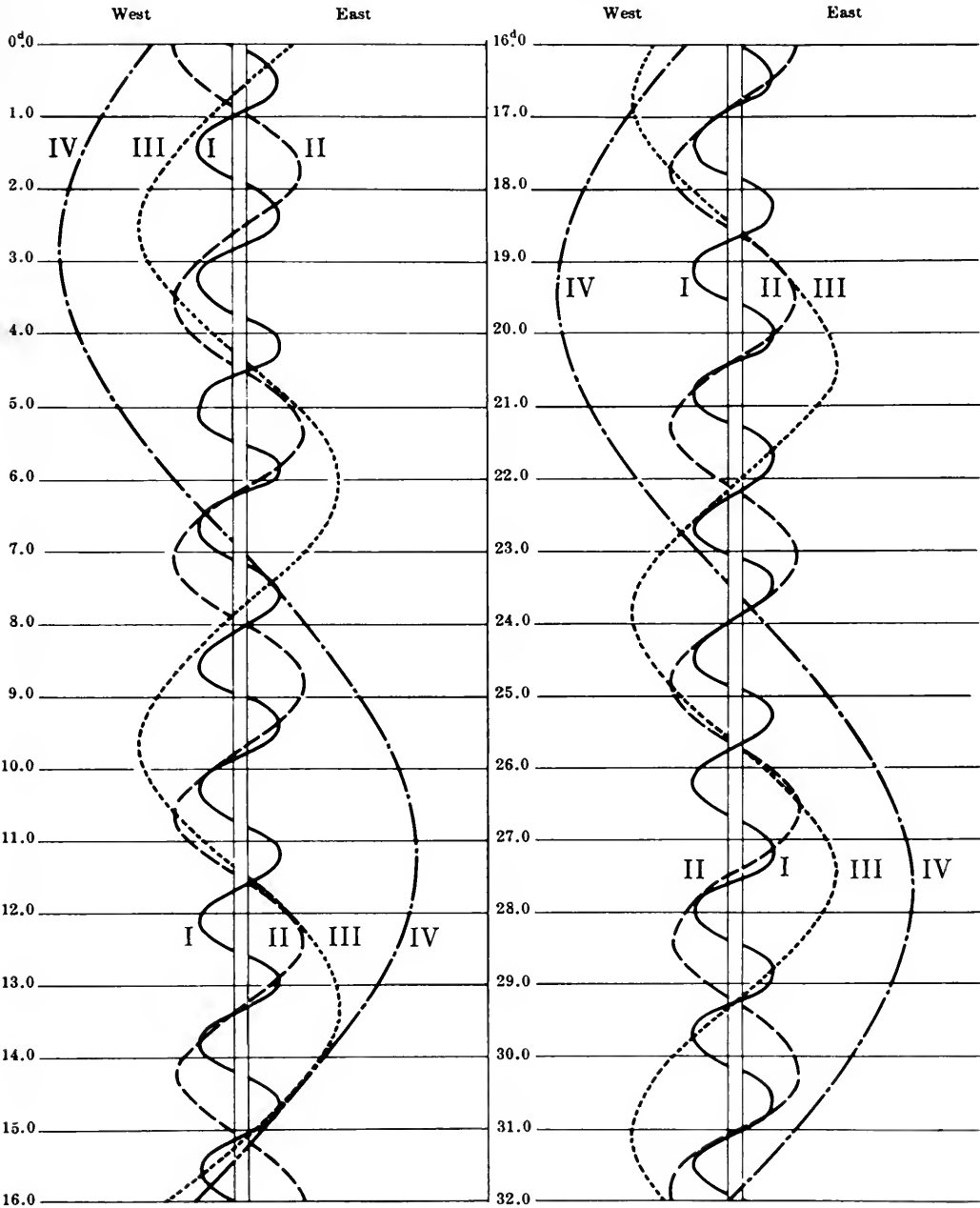
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JANUARY

d	h	m		d	h	m		d	h	m		d	h	m	
0	1	32	I. Ec.D.	8	0	43	I. Sh.I.	15	23	50	I. Ec.D.	24	0	55	II. Tr.E.
	4	20	I. Oc.R.		1	01	I. Tr.I.						1	07	II. Sh.E.
	14	03	III. Sh.I.		1	58	II. Oc.R.	16	2	14	I. Oc.R.		1	11	I. Tr.E.
	15	59	III. Tr.I.		3	00	I. Sh.E.		19	35	II. Sh.I.		1	16	I. Sh.E.
	17	35	III. Sh.E.		3	18	I. Tr.E.		19	45	II. Tr.I.		20	06	I. Oc.D.
	19	32	III. Tr.E.		21	55	I. Ec.D.		21	06	I. Sh.I.		22	31	I. Ec.R.
	19	56	II. Ec.D.						21	11	I. Tr.I.				
	22	50	I. Sh.I.	9	0	30	I. Oc.R.		22	29	II. Sh.E.	25	15	27	III. Oc.D.
	23	18	I. Tr.I.		16	58	II. Sh.I.		22	40	II. Tr.E.		16	38	II. Oc.D.
	23	44	II. Oc.R.		17	30	II. Tr.I.		23	22	I. Sh.E.		17	20	I. Tr.I.
1	1	06	I. Sh.E.		19	12	I. Sh.I.		23	27	I. Tr.E.		17	28	I. Sh.I.
	1	34	I. Tr.E.		19	27	I. Tr.I.						19	35	III. Ec.R.
	20	01	I. Ec.D.		19	52	II. Sh.E.	17	18	18	I. Ec.D.		19	36	I. Tr.E.
	22	46	I. Oc.R.		20	25	II. Tr.E.		20	40	I. Oc.R.		19	45	I. Sh.E.
					21	28	I. Sh.E.						19	46	II. Ec.R.
					21	44	I. Tr.E.	18	12	02	III. Ec.D.				
2	14	21	II. Sh.I.						14	21	II. Ec.D.	26	14	32	I. Oc.D.
	15	14	II. Tr.I.	10	16	24	I. Ec.D.		15	34	I. Sh.I.		16	59	I. Ec.R.
	17	15	II. Sh.E.		18	57	I. Oc.R.		15	36	I. Tr.I.				
	17	18	I. Sh.I.						15	46	III. Oc.R.	27	11	09	II. Tr.I.
	17	44	I. Tr.I.	11	8	02	III. Ec.D.		17	17	II. Oc.R.		11	31	II. Sh.I.
	18	09	II. Tr.E.		11	47	II. Ec.D.		17	51	I. Sh.E.		11	46	I. Tr.I.
	19	35	I. Sh.E.		12	30	III. Oc.R.		17	53	I. Tr.E.		11	57	I. Sh.I.
	20	00	I. Tr.E.		13	40	I. Sh.I.						14	02	I. Tr.E.
3	14	29	I. Ec.D.		13	53	I. Tr.I.	19	12	47	I. Ec.D.		14	03	II. Tr.E.
	17	13	I. Oc.R.		15	04	II. Oc.R.		15	05	I. Oc.R.		14	13	I. Sh.E.
					15	57	I. Sh.E.						14	26	II. Sh.E.
					16	10	I. Tr.E.	20	8	53	II. Tr.I.				
4	4	03	III. Ec.D.						8	54	II. Sh.I.	28	8	58	I. Oc.D.
	9	13	II. Ec.D.						10	02	I. Tr.I.		11	28	I. Ec.R.
	9	13	III. Oc.R.	12	10	52	I. Ec.D.		10	03	I. Sh.I.	29	5	02	III. Tr.I.
	11	47	I. Sh.I.		13	22	I. Oc.R.		11	48	II. Tr.E.		5	45	II. Oc.D.
	12	10	I. Tr.I.	13	6	17	II. Sh.I.		11	49	II. Sh.E.		5	58	III. Sh.I.
	12	51	II. Oc.R.		6	38	II. Tr.I.		12	19	I. Tr.E.		6	12	I. Tr.I.
	14	03	I. Sh.E.		8	09	I. Sh.I.		12	19	I. Sh.E.		6	25	I. Sh.I.
	14	26	I. Tr.E.		8	19	I. Tr.I.						8	28	I. Tr.E.
5	8	58	I. Ec.D.		9	11	II. Sh.E.	21	7	14	I. Oc.D.		8	35	III. Tr.E.
	11	38	I. Oc.R.		9	33	II. Tr.E.		9	34	I. Ec.R.		8	42	I. Sh.E.
					10	25	I. Sh.E.	22	1	46	III. Tr.I.		9	04	II. Ec.R.
6	3	40	II. Sh.I.		10	36	I. Tr.E.		1	59	III. Sh.I.		9	31	III. Sh.E.
	4	23	II. Tr.I.	14	5	21	I. Ec.D.		3	32	II. Oc.D.	30	3	24	I. Oc.D.
	6	15	I. Sh.I.		7	48	I. Oc.R.		4	28	I. Tr.I.		5	57	I. Ec.R.
	6	34	II. Sh.E.		22	00	III. Sh.I.		4	31	I. Sh.I.				
	6	36	I. Tr.I.		22	32	III. Tr.I.		5	20	III. Tr.E.	31	0	16	II. Tr.I.
	7	17	II. Tr.E.						5	31	III. Sh.E.		0	38	I. Tr.I.
	8	32	I. Sh.E.	15	1	04	II. Ec.D.		6	29	II. Ec.R.		0	49	II. Sh.I.
	8	52	I. Tr.E.		1	32	III. Sh.E.		6	45	I. Tr.E.		0	54	I. Sh.I.
	18	50	IV. Ec.D.		2	05	III. Tr.E.		6	48	I. Sh.E.		2	54	I. Tr.E.
7	2	22	IV. Oc.R.		2	37	I. Sh.I.						3	10	I. Sh.E.
	3	27	I. Ec.D.		2	45	I. Tr.I.	23	1	40	I. Oc.D.		3	10	II. Tr.E.
	6	04	I. Oc.R.		4	11	II. Oc.R.		4	02	I. Ec.R.		3	44	II. Sh.E.
	18	02	III. Sh.I.		4	51	IV. Sh.I.		12	00	IV. Oc.D.		20	06	IV. Tr.I.
	19	16	III. Tr.I.		4	54	I. Sh.E.		17	13	IV. Ec.R.		21	50	I. Oc.D.
	21	34	III. Sh.E.		5	01	I. Tr.E.		22	00	II. Tr.I.		22	50	IV. Sh.I.
	22	30	II. Ec.D.		5	57	IV. Tr.I.		22	12	II. Sh.I.				
	22	50	III. Tr.E.		9	06	IV. Sh.E.		22	54	I. Tr.I.				
					10	18	IV. Tr.E.		23	00	I. Sh.I.				
I. Jan. 15				II. Jan. 15				III. Jan. 18				IV. Jan. 23			
$x_1 = -1.1, y_1 = +0.1$				$x_1 = -1.2, y_1 = +0.1$				$x_1 = -1.1, y_1 = +0.2$				$x_2 = +1.2, y_2 = +0.4$			

NOTE.—I. denotes Ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JANUARY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I	d		III	d		E
W			E	W		
II	d		IV	r		E
W			E	W		

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

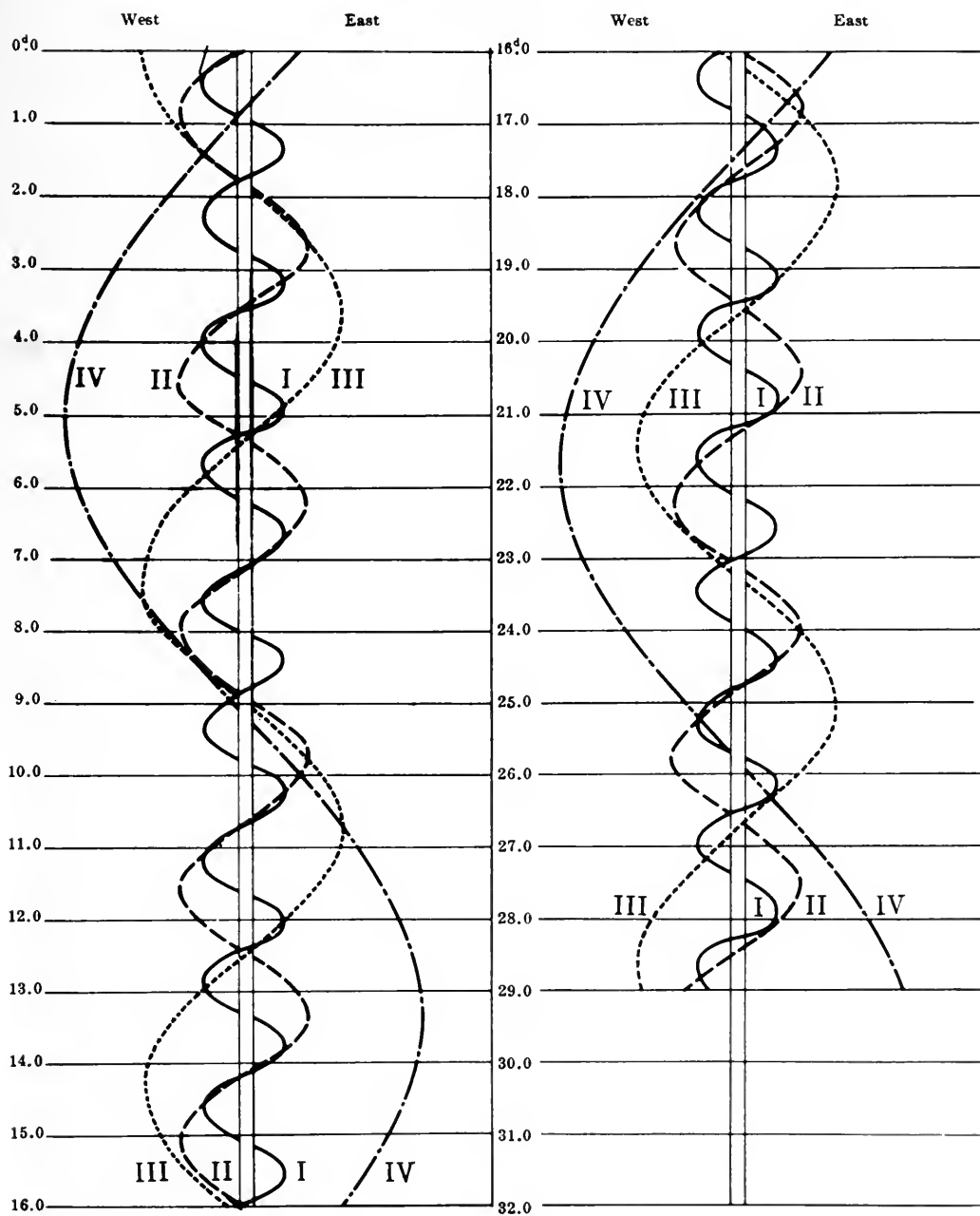
FEBRUARY

d	h	m		d	h	m		d	h	m		d	h	m		
1	0	25	IV. Tr.E.	8	20	48	I. Tr.I.	15	4	16	I. Ec.R.	22	3	07	I. Oc.D.	
	0	26	I. Ec.R.		21	06	II. Oc.D.		22	33	I. Tr.I.		6	11	I. Ec.R.	
	3	10	IV. Sh.E.		21	16	I. Sh.I.		23	11	I. Sh.I.					
	18	44	III. Oc.D.		22	02	III. Oc.D.		23	22	II. Oc.D.	23	0	19	I. Tr.I.	
	18	52	II. Oc.D.		23	04	I. Tr.E.						1	05	I. Sh.I.	
	19	04	I. Tr.I.		23	33	I. Sh.E.	16	0	49	I. Tr.E.		1	40	II. Oc.D.	
	19	22	I. Sh.I.						1	22	III. Oc.D.		2	35	I. Tr.E.	
	21	20	I. Tr.E.	9	0	55	II. Ec.R.		1	27	I. Sh.E.		3	22	I. Sh.E.	
	21	39	I. Sh.E.		2	12	IV. Oc.D.		3	30	II. Ec.R.		4	47	III. Oc.D.	
	22	21	II. Ec.R.		3	34	III. Ec.R.		7	33	III. Ec.R.		6	04	II. Ec.R.	
	23	34	III. Ec.R.		6	35	IV. Oc.R.		19	46	I. Oc.D.		11	34	III. Ec.R.	
					6	53	IV. Ec.D.		22	44	I. Ec.R.		21	33	I. Oc.D.	
2	16	16	I. Oc.D.		11	20	IV. Ec.R.									
	18	54	I. Ec.R.		18	01	I. Oc.D.	17	10	36	IV. Tr.I.	24	0	40	I. Ec.R.	
					20	49	I. Ec.R.		14	53	IV. Tr.E.		18	46	I. Tr.I.	
3	13	25	II. Tr.I.						16	50	IV. Sh.I.		19	34	I. Sh.I.	
	13	30	I. Tr.I.	10	15	14	I. Tr.I.		16	59	I. Tr.I.		20	21	II. Tr.I.	
	13	51	I. Sh.I.		15	42	II. Tr.I.		17	39	I. Sh.I.		21	02	I. Tr.E.	
	14	09	II. Sh.I.		15	45	I. Sh.I.		18	01	II. Tr.I.		21	50	I. Sh.E.	
	15	46	I. Tr.E.		16	46	II. Sh.I.		19	16	I. Tr.E.		22	01	II. Sh.I.	
	16	07	I. Sh.E.		17	30	I. Tr.E.		19	24	II. Sh.I.		23	15	II. Tr.E.	
	16	19	II. Tr.E.		18	02	I. Sh.E.		19	56	I. Sh.E.					
	17	03	II. Sh.E.		18	36	II. Tr.E.		20	54	II. Tr.E.	25	0	55	II. Sh.E.	
					19	41	II. Sh.E.		21	14	IV. Sh.E.		16	00	I. Oc.D.	
4	10	42	I. Oc.D.						22	18	II. Sh.E.		16	59	IV. Oc.D.	
	13	23	I. Ec.R.	11	12	27	I. Oc.D.						19	08	I. Ec.R.	
					15	18	I. Ec.R.						21	21	IV. Oc.R.	
5	7	56	I. Tr.I.					18	14	13	I. Oc.D.					
	7	59	II. Oc.D.						17	13	I. Ec.R.					
	8	19	I. Sh.I.	12	9	40	I. Tr.I.					26	0	56	IV. Ec.D.	
	8	19	III. Tr.I.		10	14	I. Sh.I.		19	11	26		5	27	IV. Ec.R.	
	9	56	III. Sh.I.		10	14	II. Oc.D.		12	08	I. Sh.I.		13	13	I. Tr.I.	
	10	12	I. Tr.E.		11	39	III. Tr.I.		12	31	II. Oc.D.		14	03	I. Sh.I.	
	10	36	I. Sh.E.		11	57	I. Tr.E.		13	42	I. Tr.E.		14	49	II. Oc.D.	
	11	38	II. Ec.R.		12	30	I. Sh.E.		14	25	I. Sh.E.		15	29	I. Tr.E.	
	11	52	III. Tr.E.		13	56	III. Sh.I.		15	02	III. Tr.I.		16	19	I. Sh.E.	
	13	30	III. Sh.E.		14	12	II. Ec.R.		16	47	II. Ec.R.		18	28	III. Tr.I.	
					15	11	III. Tr.E.		17	55	III. Sh.I.		19	22	II. Ec.R.	
					17	30	III. Sh.E.		18	34	III. Tr.E.		21	55	III. Sh.I.	
6	5	08	I. Oc.D.						21	29	III. Sh.E.		22	00	III. Tr.E.	
	7	52	I. Ec.R.	13	6	54	I. Oc.D.									
					9	47	I. Ec.R.					27	1	29	III. Sh.E.	
7	2	22	I. Tr.I.					20	8	40	I. Oc.D.		10	27	I. Oc.D.	
	2	33	II. Tr.I.						11	42	I. Ec.R.		13	37	I. Ec.R.	
	2	48	I. Sh.I.	14	4	07	I. Tr.I.									
	3	27	II. Sh.I.		4	42	I. Sh.I.		21	5	52	I. Tr.I.	28	7	39	I. Tr.I.
	4	38	I. Tr.E.		4	50	II. Tr.I.		6	37	I. Sh.I.		8	31	I. Sh.I.	
	5	05	I. Sh.E.		6	04	II. Sh.I.		7	10	II. Tr.I.		9	32	II. Tr.I.	
	5	27	II. Tr.E.		6	23	I. Tr.E.		8	09	I. Tr.E.		9	55	I. Tr.E.	
	6	21	II. Sh.E.		6	59	I. Sh.E.		8	42	II. Sh.I.		10	48	I. Sh.E.	
	23	35	I. Oc.D.		7	45	II. Tr.E.		8	53	I. Sh.E.		11	20	II. Sh.I.	
					8	59	II. Sh.E.		10	04	II. Tr.E.		12	26	II. Tr.E.	
8	2	21	I. Ec.R.						11	36	II. Sh.E.		14	14	II. Sh.E.	
				15	1	20	I. Oc.D.									
I. Feb. 13				II. Feb. 12				III. Feb. 16				IV. Feb. 9				
$x_2=+1.5, y_2=+0.1$				$x_2=+1.8, y_2=+0.1$				$x_2=+2.4, y_2=+0.2$				$x_1=+1.0, y_1=+0.4$ $x_2=+2.8, y_2=+0.4$				





NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR FEBRUARY

UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p> 	<p>III E W</p>  <p>E</p>
<p>II W</p> 	<p>IV E W</p>  <p>E</p>

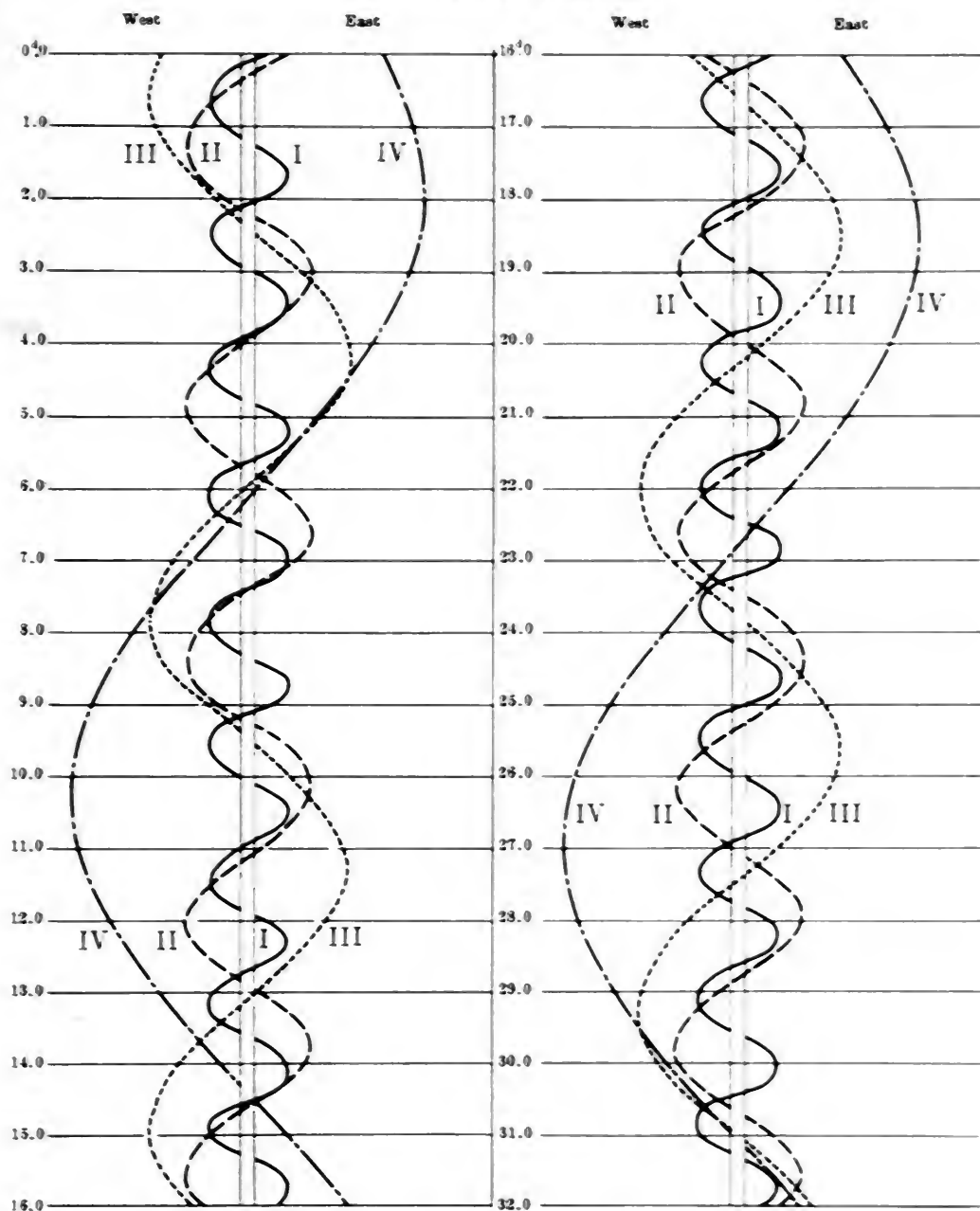
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

MARCH

d	h	m		d	h	m		d	h	m		d	h	m	
1	4	54	I. Oc.D.	9	4	55	I. Sh.I.	16	13	50	II. Ec.R.	24	3	35	III. Ec.R.
	8	06	I. Ec.R.		6	10	I. Tr.E.		15	29	III. Oc.D.		4	51	I. Oc.D.
					6	21	II. Oc.D.		19	02	III. Oc.R.		8	21	I. Ec.R.
2	2	06	I. Tr.I.		7	11	I. Sh.E.		19	59	III. Ec.D.				
	3	00	I. Sh.I.		11	14	II. Ec.R.		23	35	III. Ec.R.	25	2	03	I. Tr.I.
	3	59	II. Oc.D.		11	51	III. Oc.D.						3	13	I. Sh.I.
	4	22	I. Tr.E.		15	24	III. Oc.R.	17	3	00	I. Oc.D.		4	18	I. Tr.E.
	5	16	I. Sh.E.		15	59	III. Ec.D.		6	26	I. Ec.R.		5	29	I. Sh.E.
	8	16	III. Oc.D.		19	35	III. Ec.R.						6	06	II. Tr.I.
	8	39	II. Ec.R.					18	0	12	I. Tr.I.		8	32	II. Sh.I.
	11	50	III. Oc.R.	10	1	10	I. Oc.D.		1	18	I. Sh.I.		8	59	II. Tr.E.
	11	58	III. Ec.D.		4	30	I. Ec.R.		2	27	I. Tr.E.		11	25	II. Sh.E.
	15	34	III. Ec.R.		22	22	I. Tr.I.		3	34	I. Sh.E.		23	19	I. Oc.D.
	23	21	I. Oc.D.		23	23	I. Sh.I.		3	37	II. Tr.I.				
									5	54	II. Sh.I.	26	2	49	I. Ec.R.
3	2	35	I. Ec.R.	11	0	38	I. Tr.E.		6	30	II. Tr.E.		20	30	I. Tr.I.
	20	33	I. Tr.I.		1	09	II. Tr.I.		8	48	II. Sh.E.		21	42	I. Sh.I.
	21	29	I. Sh.I.		1	39	I. Sh.E.		21	28	I. Oc.D.		22	46	I. Tr.E.
	22	44	II. Tr.I.		3	17	II. Sh.I.						23	58	I. Sh.E.
	22	49	I. Tr.E.		4	02	II. Tr.E.	19	0	54	I. Ec.R.	27	0	26	II. Oc.D.
	23	45	I. Sh.E.		6	10	II. Sh.E.		18	39	I. Tr.I.		5	43	II. Ec.R.
4	0	39	II. Sh.I.		19	37	I. Oc.D.		19	47	I. Sh.I.		9	00	III. Tr.I.
	1	38	II. Tr.E.		22	58	I. Ec.R.		20	55	I. Tr.E.		12	31	III. Tr.E.
	3	33	II. Sh.E.	12	16	49	I. Tr.I.		21	58	II. Oc.D.		13	52	III. Sh.I.
	17	48	I. Oc.D.		17	52	I. Sh.I.		22	03	I. Sh.E.		17	27	III. Sh.E.
	21	03	I. Ec.R.		19	05	I. Tr.E.	20	3	07	II. Ec.R.		17	47	I. Oc.D.
					19	33	II. Oc.D.		5	15	III. Tr.I.		21	19	I. Ec.R.
					20	08	I. Sh.E.		8	46	III. Tr.E.	28	14	58	I. Tr.I.
5	15	00	I. Tr.I.	13	0	32	II. Ec.R.		9	53	III. Sh.I.		16	10	I. Sh.I.
	15	57	I. Sh.I.		1	34	III. Tr.I.		13	27	III. Sh.E.		17	14	I. Tr.E.
	17	10	II. Oc.D.		5	06	III. Tr.E.		15	55	I. Oc.D.		18	26	I. Sh.E.
	17	16	I. Tr.E.		5	54	III. Sh.I.		19	23	I. Ec.R.		19	22	II. Tr.I.
	18	13	I. Sh.E.		9	27	III. Sh.E.	21	13	07	I. Tr.I.		21	50	II. Sh.I.
	21	57	II. Ec.R.		14	05	I. Oc.D.		14	15	I. Sh.I.		22	14	II. Tr.E.
	21	59	III. Tr.I.		17	28	I. Ec.R.		15	23	I. Tr.E.	29	0	43	II. Sh.E.
6	1	31	III. Tr.E.	14	8	37	IV. Oc.D.		16	32	I. Sh.E.		12	15	I. Oc.D.
	1	50	IV. Tr.I.		11	17	I. Tr.I.		16	51	II. Tr.I.		15	48	I. Ec.R.
	1	54	III. Sh.I.		12	21	I. Sh.I.		19	13	II. Sh.I.				
	5	28	III. Sh.E.		12	59	IV. Oc.R.		19	44	II. Tr.E.	30	9	27	I. Tr.I.
	6	06	IV. Tr.E.		13	32	I. Tr.E.		22	06	II. Sh.E.		10	39	I. Sh.I.
	10	51	IV. Sh.I.		14	22	II. Tr.I.	22	10	23	I. Oc.D.		11	42	I. Tr.E.
	12	15	I. Oc.D.		14	37	I. Sh.E.		13	52	I. Ec.R.		12	55	I. Sh.E.
	15	18	IV. Sh.E.		16	35	II. Sh.I.		18	00	IV. Tr.I.		13	41	II. Oc.D.
	15	32	I. Ec.R.		17	15	II. Tr.E.		22	16	IV. Tr.E.		19	00	II. Ec.R.
7	9	27	I. Tr.I.		18	59	IV. Ec.D.	23	4	52	IV. Sh.I.		22	58	III. Oc.D.
	10	26	I. Sh.I.		19	28	II. Sh.E.		7	35	I. Tr.I.	31	1	16	IV. Oc.D.
	11	43	I. Tr.E.		23	34	IV. Ec.R.		8	44	I. Sh.I.		2	32	III. Oc.R.
	11	56	II. Tr.I.						9	22	IV. Sh.E.		3	58	III. Ec.D.
	12	42	I. Sh.E.	15	8	32	I. Oc.D.		9	50	I. Tr.E.		5	39	IV. Oc.R.
	13	57	II. Sh.I.		11	57	I. Ec.R.		11	00	I. Sh.E.		6	43	I. Oc.D.
	14	49	II. Tr.E.	16	5	44	I. Tr.I.		11	12	II. Oc.D.		7	34	III. Ec.R.
	16	51	II. Sh.E.		6	49	I. Sh.I.		16	25	II. Ec.R.		10	16	I. Ec.R.
8	6	43	I. Oc.D.		8	00	I. Tr.E.		19	11	III. Oc.D.		13	03	IV. Ec.D.
	10	01	I. Ec.R.		8	45	II. Oc.D.		22	45	III. Oc.R.		17	41	IV. Ec.R.
9	3	55	I. Tr.I.		9	05	I. Sh.E.		23	58	III. Ec.D.				
I. Mar. 17				II. Mar. 16				III. Mar. 16				IV. Mar. 14			
$x_2=+1.9, y_2=+0.1$				$x_2=+2.5, y_2=0.0$				$x_1=+1.5, y_1=+0.2$ $x_2=+3.4, y_2=+0.2$				$x_1=+3.3, y_1=+0.3$ $x_2=+5.2, y_2=+0.3$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

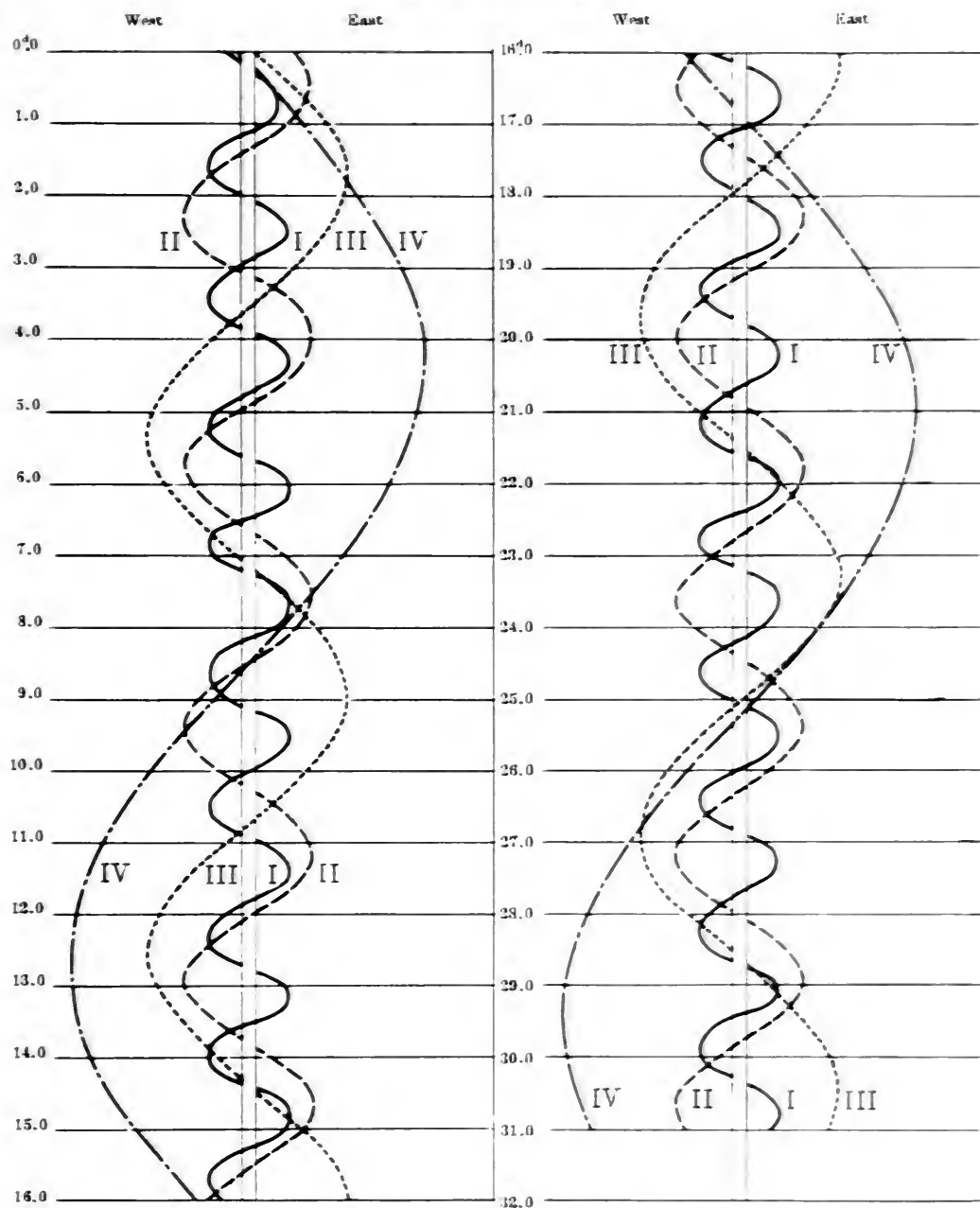
CONFIGURATIONS OF SATELLITES I-IV FOR MARCH
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		r	.	E	III		d	r	.	E
W					W					
II		r	.	E	IV		d	r	.	E
W					W					

CONFIGURATIONS OF SATELLITES I-IV FOR APRIL
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I					III				
W		r	.	E	W		d	r	E
II					IV				
W		r	.	E	W		d	r	E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

MAY

d	h	m		d	h	m		d	h	m		d	h	m	
1	6	03	I. Tr.I.	9	5	19	I. Oc.D.	17	4	27	I. Tr.I.	24	19	28	II. Tr.E.
	7	16	I. Sh.I.		8	50	I. Ec.R.		5	35	I. Sh.I.		21	38	II. Sh.E.
	8	18	I. Tr.E.		8	58	III. Tr.I.		6	43	I. Tr.E.				
	9	33	I. Sh.E.		12	31	III. Tr.E.		7	52	I. Sh.E.	25	3	46	I. Oc.D.
	13	18	II. Oc.D.		13	51	III. Sh.I.		13	51	II. Tr.I.		7	09	I. Ec.R.
	18	42	II. Ec.R.		17	27	III. Sh.E.		16	09	II. Sh.I.				
									16	44	II. Tr.E.	26	0	55	I. Tr.I.
2	3	22	I. Oc.D.	10	2	29	I. Tr.I.		19	02	II. Sh.E.		1	59	I. Sh.I.
	4	49	III. Tr.I.		3	40	I. Sh.I.	18	1	48	I. Oc.D.		3	12	I. Tr.E.
	6	55	I. Ec.R.		4	45	I. Tr.E.		5	14	I. Ec.R.		4	16	I. Sh.E.
	8	22	III. Tr.E.		5	57	I. Sh.E.		22	57	I. Tr.I.		10	46	II. Oc.D.
	9	51	III. Sh.I.		11	08	II. Tr.I.						15	49	II. Ec.R.
	13	27	III. Sh.E.		13	33	II. Sh.I.	19	0	04	I. Sh.I.		22	16	I. Oc.D.
					14	00	II. Tr.E.		1	13	I. Tr.E.	27	1	38	I. Ec.R.
3	0	32	I. Tr.I.		16	25	II. Sh.E.		2	21	I. Sh.E.		7	39	III. Oc.D.
	1	45	I. Sh.I.		23	49	I. Oc.D.		8	02	II. Oc.D.		11	15	III. Oc.R.
	2	48	I. Tr.E.						13	12	II. Ec.R.		11	56	III. Ec.D.
	4	02	I. Sh.E.	11	3	19	I. Ec.R.		20	17	I. Oc.D.		15	34	III. Ec.R.
	8	26	II. Tr.I.		20	58	I. Tr.I.		23	43	I. Ec.R.		19	25	I. Tr.I.
	10	56	II. Sh.I.		22	09	I. Sh.I.	20	3	23	III. Oc.D.		20	28	I. Sh.I.
	11	19	II. Tr.E.		23	15	I. Tr.E.		6	59	III. Oc.R.		21	42	I. Tr.E.
	13	20	IV. Oc.D.		23	55	IV. Tr.I.		7	57	III. Ec.D.		22	45	I. Sh.E.
	13	49	II. Sh.E.	12	0	26	I. Sh.E.		8	30	IV. Oc.D.	28	5	58	II. Tr.I.
	17	48	IV. Oc.R.		4	19	IV. Tr.E.		11	35	III. Ec.R.		8	04	II. Sh.I.
	21	52	I. Oc.D.		5	19	II. Oc.D.		13	03	IV. Oc.R.		8	50	II. Tr.E.
4	1	10	IV. Ec.D.		10	36	II. Ec.R.		17	26	I. Tr.I.		10	56	II. Sh.E.
	1	24	I. Ec.R.		10	56	IV. Sh.I.		18	33	I. Sh.I.		16	46	I. Oc.D.
	5	55	IV. Ec.R.		15	35	IV. Sh.E.		19	14	IV. Ec.D.		19	18	IV. Tr.I.
	19	01	I. Tr.I.		18	19	I. Oc.D.		19	43	I. Tr.E.		20	07	I. Ec.R.
	20	14	I. Sh.I.		21	48	I. Ec.R.		20	50	I. Sh.E.		23	47	IV. Tr.E.
	21	17	I. Tr.E.		23	10	III. Oc.D.	21	0	01	IV. Ec.R.	29	4	58	IV. Sh.I.
	22	30	I. Sh.E.						3	13	II. Tr.I.		9	39	IV. Sh.E.
5	2	38	II. Oc.D.	13	2	45	III. Oc.R.		5	28	II. Sh.I.		13	55	I. Tr.I.
	8	00	II. Ec.R.		3	57	III. Ec.D.		6	06	II. Tr.E.		14	57	I. Sh.I.
	16	21	I. Oc.D.		7	35	III. Ec.R.		8	20	II. Sh.E.		16	12	I. Tr.E.
	18	59	III. Oc.D.		15	28	I. Tr.I.		14	47	I. Oc.D.		17	14	I. Sh.E.
	19	53	I. Ec.R.		16	38	I. Sh.I.		18	12	I. Ec.R.				
	22	34	III. Oc.R.		17	44	I. Tr.E.	22	11	56	I. Tr.I.	30	0	08	II. Oc.D.
	23	58	III. Ec.D.		18	55	I. Sh.E.		13	02	I. Sh.I.		5	07	II. Ec.R.
6	3	36	III. Ec.R.	14	0	30	II. Tr.I.		14	13	I. Tr.E.		11	16	I. Oc.D.
	13	30	I. Tr.I.		2	51	II. Sh.I.		15	18	I. Sh.E.		14	35	I. Ec.R.
	14	43	I. Sh.I.		3	22	II. Tr.E.		21	23	II. Oc.D.		21	43	III. Tr.I.
	15	46	I. Tr.E.		5	44	II. Sh.E.					31	1	18	III. Tr.E.
	16	59	I. Sh.E.		12	48	I. Oc.D.		2	30	II. Ec.R.		1	50	III. Sh.I.
	21	47	II. Tr.I.		16	17	I. Ec.R.		9	17	I. Oc.D.		5	27	III. Sh.E.
7	0	15	II. Sh.I.	15	9	57	I. Tr.I.		12	41	I. Ec.R.		8	25	I. Tr.I.
	0	40	II. Tr.E.		11	07	I. Sh.I.		17	26	III. Tr.I.		9	25	I. Sh.I.
	3	07	II. Sh.E.		12	14	I. Tr.E.		21	00	III. Tr.E.		10	42	I. Tr.E.
	10	50	I. Oc.D.		13	23	I. Sh.E.		21	51	III. Sh.I.		11	43	I. Sh.E.
	14	22	I. Ec.R.		18	40	II. Oc.D.						19	20	II. Tr.I.
					23	54	II. Ec.R.	24	1	27	III. Sh.E.		21	22	II. Sh.I.
8	8	00	I. Tr.I.	16	7	18	I. Oc.D.		6	26	I. Tr.I.		22	13	II. Tr.E.
	9	12	I. Sh.I.		10	46	I. Ec.R.		7	30	I. Sh.I.				
	10	16	I. Tr.E.		13	10	III. Tr.I.		8	42	I. Tr.E.				
	11	28	I. Sh.E.		16	44	III. Tr.E.		9	47	I. Sh.E.				
	15	58	II. Oc.D.		17	51	III. Sh.I.		16	35	II. Tr.I.				
	21	18	II. Ec.R.		21	27	III. Sh.E.		18	46	II. Sh.I.				
I. May 16				II. May 15				III. May 13				IV. May 20-21			
$x_2=+2.0, y_2=0.0$				$x_2=+2.6, y_2=0.0$				$x_1=+1.6, y_1=+0.1$ $x_2=+3.6, y_2=+0.1$				$x_1=+3.4, y_1=+0.2$ $x_2=+5.3, y_2=+0.2$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

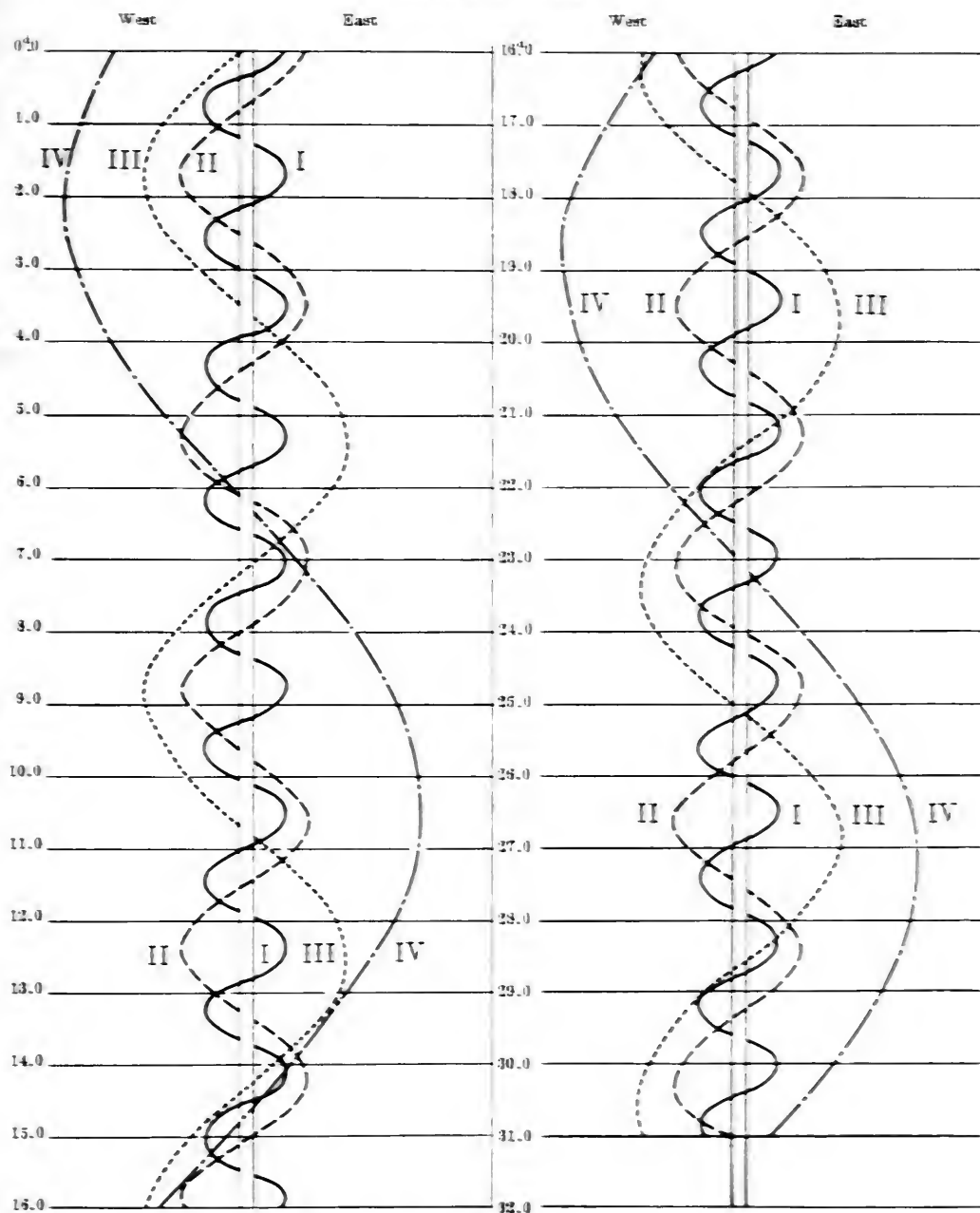
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JUNE

d	h	m		d	h	m		d	h	m		d	h	m	
1	0	14	II. Sh.E.	8	2	50	II. Sh.E.	15	5	26	II. Sh.E.	23	7	20	IV. Ec.D.
	5	46	I. Oc.D.		7	46	I. Oc.D.		9	46	I. Oc.D.		8	55	I. Tr.I.
	9	04	I. Ec.R.		10	59	I. Ec.R.		12	54	I. Ec.R.		9	39	I. Sh.I.
2	2	55	I. Tr.I.	9	4	55	I. Tr.I.	16	6	55	I. Tr.I.		11	12	I. Tr.E.
	3	54	I. Sh.I.		5	49	I. Sh.I.		7	44	I. Sh.I.		11	56	I. Sh.E.
	5	12	I. Tr.E.		7	11	I. Tr.E.		9	12	I. Tr.E.		12	11	IV. Ec.R.
	6	11	I. Sh.E.		8	06	I. Sh.E.		10	01	I. Sh.E.		21	53	II. Oc.D.
	13	31	II. Oc.D.		16	17	II. Oc.D.		19	05	II. Oc.D.	24	2	15	II. Ec.R.
	18	25	II. Ec.R.		21	02	II. Ec.R.		23	39	II. Ec.R.		6	16	I. Oc.D.
													9	17	I. Ec.R.
3	0	16	I. Oc.D.	10	2	16	I. Oc.D.	17	4	16	I. Oc.D.	25	1	04	III. Oc.D.
	3	33	I. Ec.R.		5	28	I. Ec.R.		7	22	I. Ec.R.		3	26	I. Tr.I.
	11	57	III. Oc.D.		16	18	III. Oc.D.		20	40	III. Oc.D.		4	08	I. Sh.I.
	15	34	III. Oc.R.		19	55	III. Oc.R.						5	43	I. Tr.E.
	15	56	III. Ec.D.		19	55	III. Ec.D.	18	1	25	I. Tr.I.		6	25	I. Sh.E.
	19	34	III. Ec.R.		23	25	I. Tr.I.		2	12	I. Sh.I.		7	33	III. Ec.R.
	21	25	I. Tr.I.		23	34	III. Ec.R.		3	34	III. Ec.R.		17	03	II. Tr.I.
	22	23	I. Sh.I.						3	42	I. Tr.E.		18	26	II. Sh.I.
	23	42	I. Tr.E.	11	0	18	I. Sh.I.		4	30	I. Sh.E.		19	56	II. Tr.E.
					1	42	I. Tr.E.		14	16	II. Tr.I.		21	19	II. Sh.E.
4	0	40	I. Sh.E.		2	35	I. Sh.E.		15	51	II. Sh.I.				
	8	43	II. Tr.I.		11	29	II. Tr.I.		17	09	II. Tr.E.				
	10	40	II. Sh.I.		13	16	II. Sh.I.		18	43	II. Sh.E.	26	0	47	I. Oc.D.
	11	36	II. Tr.E.		14	22	II. Tr.E.		22	46	I. Oc.D.		3	46	I. Ec.R.
	13	32	II. Sh.E.		16	08	II. Sh.E.						21	56	I. Tr.I.
	18	46	I. Oc.D.		20	46	I. Oc.D.	19	1	52	I. Ec.R.		22	36	I. Sh.I.
	22	02	I. Ec.R.		23	56	I. Ec.R.		19	55	I. Tr.I.				
									20	41	I. Sh.I.	27	0	14	I. Tr.E.
5	15	55	I. Tr.I.	12	17	55	I. Tr.I.		22	13	I. Tr.E.		0	55	I. Sh.E.
	16	52	I. Sh.I.		18	47	I. Sh.I.		23	00	I. Sh.E.		11	17	II. Oc.D.
	18	12	I. Tr.E.		20	12	I. Tr.E.						15	34	II. Ec.R.
	19	09	I. Sh.E.		21	04	I. Sh.E.	20	8	29	II. Oc.D.		19	17	I. Oc.D.
									12	57	II. Ec.R.		22	14	I. Ec.R.
6	2	54	II. Oc.D.	13	5	41	II. Oc.D.		17	16	I. Oc.D.				
	4	13	IV. Oc.D.		10	20	II. Ec.R.		20	20	I. Ec.R.	28	15	10	III. Tr.I.
	7	43	II. Ec.R.		15	16	I. Oc.D.						16	26	I. Tr.I.
	8	50	IV. Oc.R.		18	25	I. Ec.R.	21	10	45	III. Tr.I.		17	05	I. Sh.I.
	13	16	I. Oc.D.						13	49	III. Sh.I.		17	48	III. Sh.I.
	13	17	IV. Ec.D.	14	6	23	III. Tr.I.		14	22	III. Tr.E.		18	44	I. Tr.E.
	16	30	I. Ec.R.		9	49	III. Sh.I.		14	25	I. Tr.I.		18	47	III. Tr.E.
	18	06	IV. Ec.R.		9	59	III. Tr.E.		15	10	I. Sh.I.		19	23	I. Sh.E.
					12	25	I. Tr.I.		16	43	I. Tr.E.		21	27	III. Sh.E.
7	2	02	III. Tr.I.		13	15	I. Sh.I.		17	27	III. Sh.E.				
	5	37	III. Tr.E.		13	27	III. Sh.E.		17	28	I. Sh.E.	29	6	27	II. Tr.I.
	5	50	III. Sh.I.		14	42	I. Tr.E.						7	44	II. Sh.I.
	9	27	III. Sh.E.		15	08	IV. Tr.I.						9	20	II. Tr.E.
	10	25	I. Tr.I.		15	33	I. Sh.E.	22	3	40	II. Tr.I.		10	36	II. Sh.E.
	11	20	I. Sh.I.		19	43	IV. Tr.E.		5	09	II. Sh.I.		13	47	I. Oc.D.
	12	42	I. Tr.E.		22	59	IV. Sh.I.		6	32	II. Tr.E.		16	43	I. Ec.R.
	13	38	I. Sh.E.						8	01	II. Sh.E.				
	22	06	II. Tr.I.	15	0	53	II. Tr.I.		11	46	I. Oc.D.				
	23	58	II. Sh.I.		2	33	II. Sh.I.		14	48	I. Ec.R.	30	10	56	I. Tr.I.
					3	42	IV. Sh.E.						11	33	I. Sh.I.
8	0	59	II. Tr.E.		3	45	II. Tr.E.	23	0	21	IV. Oc.D.		13	14	I. Tr.E.
									5	03	IV. Oc.R.		13	52	I. Sh.E.
I. June 15				II. June 16				III. June 10				IV. June 23			
$x_2=+1.7, y_2=0.0$				$x_2=+2.1, y_2=0.0$				$x_1=+1.0, y_1=+0.1$ $x_2=+3.0, y_2=+0.1$				$x_1=+1.9, y_1=+0.1$ $x_2=+3.8, y_2=+0.1$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JUNE
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I				III			
W		r	E	W		d	E
II				IV			
W		r	E	W		d	E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

JULY

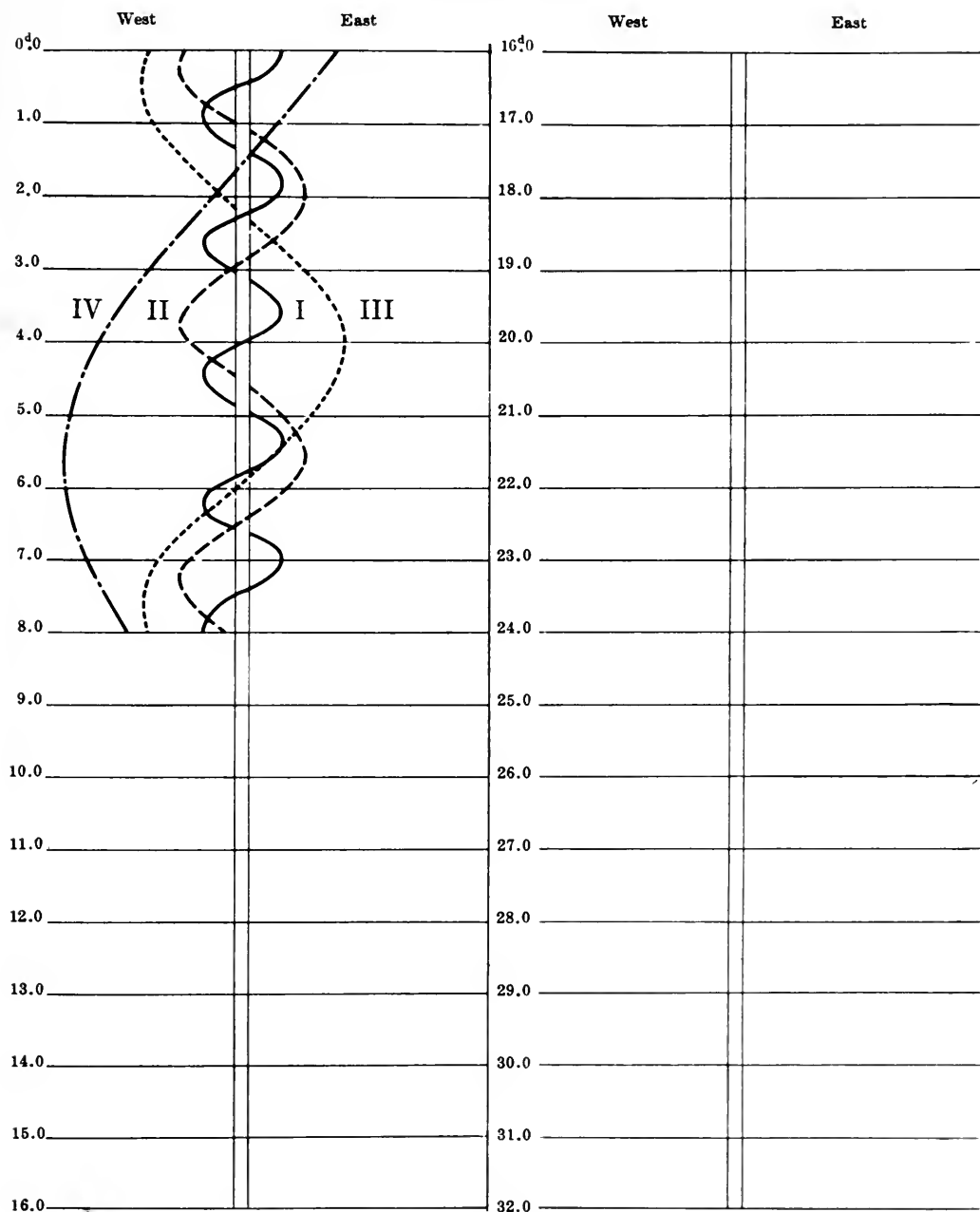
d	h	m		d	h	m		d	h	m		d	h	m	
1	0	42	II. Oc.D.	2	19	51	II. Tr.I.	5	0	09	I. Ec.R.	6	18	37	I. Ec.R.
	4	52	II. Ec.R.		21	02	II. Sh.I.		18	27	I. Tr.I.				
	8	17	I. Oc.D.		22	43	II. Tr.E.		19	00	I. Sh.I.	7	12	57	I. Tr.I.
	11	12	I. Ec.R.		23	54	II. Sh.E.		19	35	III. Tr.I.		13	28	I. Sh.I.
	11	19	IV. Tr.I.						20	45	I. Tr.E.		15	15	I. Tr.E.
	15	59	IV. Tr.E.	3	2	47	I. Oc.D.		21	18	I. Sh.E.		15	47	I. Sh.E.
	16	59	IV. Sh.I.		5	40	I. Ec.R.		21	47	III. Sh.I.				
	21	44	IV. Sh.E.		23	57	I. Tr.I.		23	13	III. Tr.E.	8	3	32	II. Oc.D.
2	5	27	I. Tr.I.	4	0	31	I. Sh.I.	6	1	26	III. Sh.E.		7	29	II. Ec.R.
	5	28	III. Oc.D.		2	15	I. Tr.E.		9	15	II. Tr.I.		10	18	I. Oc.D.
	6	03	I. Sh.I.		2	50	I. Sh.E.		10	19	II. Sh.I.		13	06	I. Ec.R.
	7	44	I. Tr.E.		14	07	II. Oc.D.		12	07	II. Tr.E.				
	8	20	I. Sh.E.		18	10	II. Ec.R.		13	11	II. Sh.E.				
	11	32	III. Ec.R.		21	18	I. Oc.D.		15	48	I. Oc.D.				

By reason of the proximity of JUPITER to the SUN the phenomena of the satellites are not given from July 9 to August 26.




I. July 8	II. July 8	III. July 2	IV.
$x_2=+1.4, y_2=0.0$	$x_2=+1.7, y_2=0.0$	$x_2=+2.3, y_2=+0.1$	No eclipse

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec. eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR JULY
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I		III	
W		E	
II		IV	
W		E	No eclipse

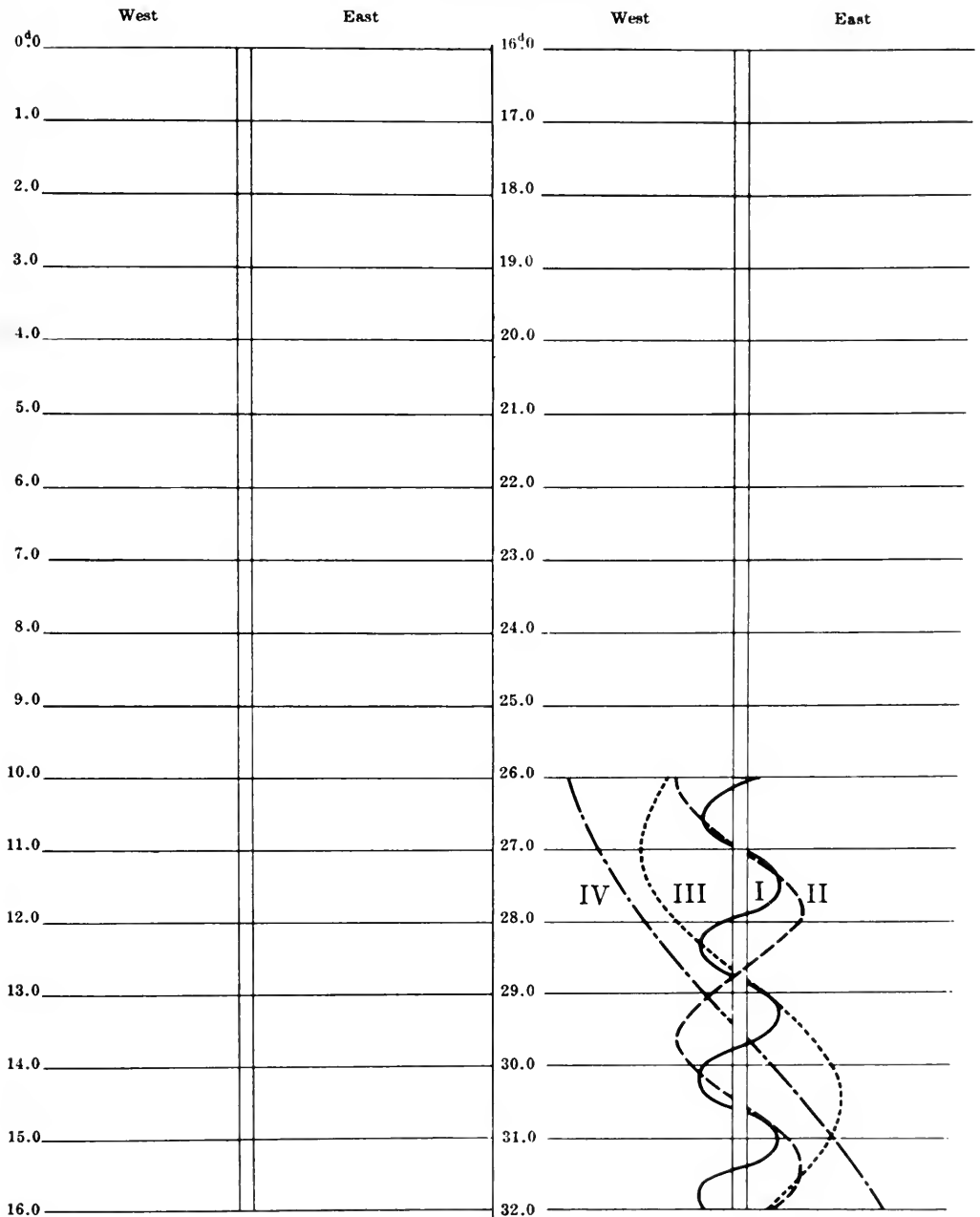
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

AUGUST

<div><div><div>d h m</div><div>26 2 51</div><div>3 08</div><div>5 09</div><div>5 26</div><div>22 52</div></div><div><div>I. Sh.I.</div><div>I. Tr.I.</div><div>I. Sh.E.</div><div>I. Tr.E.</div><div>II. Ec.D.</div></div></div>	<div><div><div>d h m</div><div>27 21 38</div><div>23 38</div><div>23 57</div></div><div><div>I. Tr.I.</div><div>I. Sh.E.</div><div>I. Tr.E.</div></div></div> <div><div><div>d h m</div><div>28 15 43</div><div>17 36</div><div>18 14</div><div>18 35</div><div>20 27</div><div>20 42</div></div><div><div>III. Ec.D.</div><div>II. Sh.I.</div><div>II. Tr.I.</div><div>I. Ec.D.</div><div>II. Sh.E.</div><div>III. Oc.R.</div></div></div>	<div><div><div>d h m</div><div>28 21 06</div><div>21 12</div></div><div><div>II. Tr.E.</div><div>I. Oc.R.</div></div></div> <div><div><div>d h m</div><div>29 7 28</div><div>15 40</div><div>15 48</div><div>16 08</div><div>18 06</div><div>18 27</div></div><div><div>IV. Ec.D.</div><div>IV. Oc.R.</div><div>I. Sh.I.</div><div>I. Tr.I.</div><div>I. Sh.E.</div><div>I. Tr.E.</div></div></div>	<div><div><div>d h m</div><div>30 12 10</div><div>13 03</div><div>15 42</div><div>15 49</div></div><div><div>II. Ec.D.</div><div>I. Ec.D.</div><div>I. Oc.R.</div><div>II. Oc.R.</div></div></div> <div><div><div>d h m</div><div>31 10 17</div><div>10 39</div><div>12 35</div><div>12 57</div></div><div><div>I. Sh.I.</div><div>I. Tr.I.</div><div>I. Sh.E.</div><div>I. Tr.E.</div></div></div>
I. Aug. 27	II. Aug. 26	III. Aug. 28	IV. Aug. 29
$x_1=-1.3, \quad y_1=0.0$	$x_1=-1.4, \quad y_1=-0.1$	$x_1=-1.7, \quad y_1=0.0$	$x_1=-2.3, \quad y_1=0.0$

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR AUGUST
UNIVERSAL TIME



PHASES OF THE ECLIPSES

I	d		III	d		E
W			E	W		E
II	d		IV	d		E
W			E	W		E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

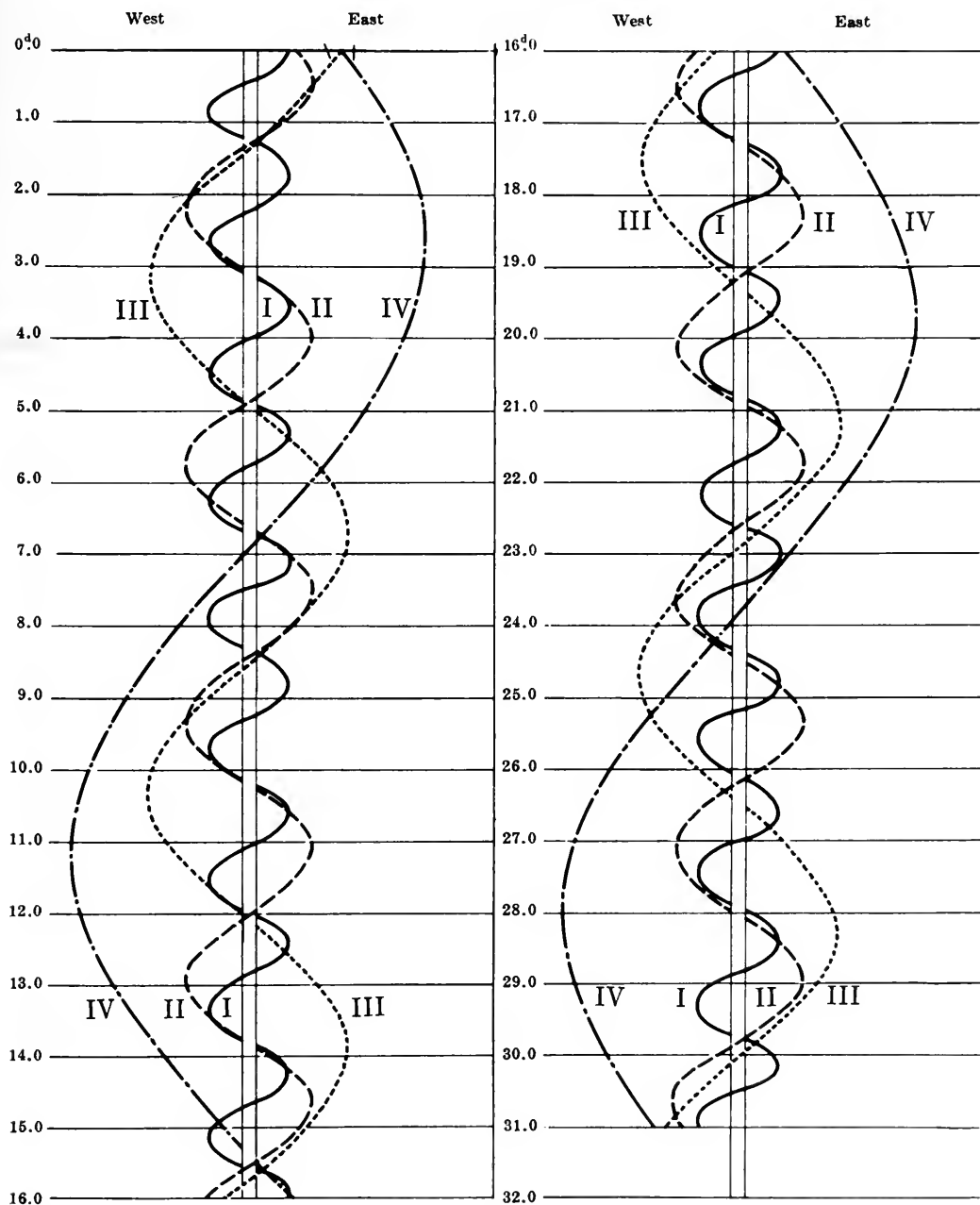
SEPTEMBER

d	h	m		d	h	m		d	h	m		d	h	m	
1	5	40	III. Sh.I.	8	10	25	II. Tr.I.	15	16	02	II. Tr.E.	23	11	11	I. Tr.I.
	6	52	II. Sh.I.		11	40	III. Tr.I.		16	05	III. Tr.I.		12	46	I. Sh.E.
	7	14	III. Tr.I.		12	12	I. Oc.R.		17	17	III. Sh.E.		13	29	I. Tr.E.
	7	32	I. Ec.D.		12	17	II. Sh.E.		19	45	III. Tr.E.		15	42	IV. Sh.E.
	7	38	II. Tr.I.		13	16	II. Tr.E.						17	40	IV. Tr.I.
	9	20	III. Sh.E.		13	18	III. Sh.E.	16	8	33	I. Sh.I.		22	27	IV. Tr.E.
	9	44	II. Sh.E.		15	20	III. Tr.E.		9	10	I. Tr.I.				
	10	12	I. Oc.R.						10	52	I. Sh.E.	24	7	40	I. Ec.D.
	10	29	II. Tr.E.	9	6	39	I. Sh.I.		11	29	I. Tr.E.		9	18	II. Ec.D.
	10	54	III. Tr.E.		7	10	I. Tr.I.						10	41	I. Oc.R.
					8	57	I. Sh.E.	17	5	47	I. Ec.D.		13	43	II. Oc.R.
					9	28	I. Tr.E.		6	42	II. Ec.D.				
									8	42	I. Oc.R.	25	4	56	I. Sh.I.
2	4	45	I. Sh.I.						10	54	II. Oc.R.		5	41	I. Tr.I.
	5	09	I. Tr.I.										7	14	I. Sh.E.
	7	03	I. Sh.E.	10	3	53	I. Ec.D.								
	7	27	I. Tr.E.		4	05	II. Ec.D.						7	59	I. Tr.E.
					6	42	I. Oc.R.	18	3	02	I. Sh.I.				
					8	05	II. Oc.R.		3	41	I. Tr.I.				
3	1	29	II. Ec.D.						5	20	I. Sh.E.	26	2	09	I. Ec.D.
	2	00	I. Ec.D.						5	59	I. Tr.E.		3	50	II. Sh.I.
	4	42	I. Oc.R.	11	1	08	I. Sh.I.						5	11	I. Oc.R.
	5	14	II. Oc.R.		1	40	I. Tr.I.						5	19	II. Tr.I.
	23	14	I. Sh.I.		3	26	I. Sh.E.	19	0	15	I. Ec.D.		6	40	II. Sh.E.
	23	39	I. Tr.I.		3	59	I. Tr.E.		1	16	II. Sh.I.		7	36	III. Ec.D.
					22	22	I. Ec.D.		2	34	II. Tr.I.		8	10	II. Tr.E.
4	1	32	I. Sh.E.		22	43	II. Sh.I.		3	12	I. Oc.R.		14	20	III. Oc.R.
	1	58	I. Tr.E.		23	39	III. Ec.D.		3	37	III. Ec.D.		23	25	I. Sh.I.
	19	40	III. Ec.D.		23	48	II. Tr.I.		4	07	II. Sh.E.				
	20	09	II. Sh.I.						5	25	II. Tr.E.				
	20	28	I. Ec.D.	12	1	12	I. Oc.R.		9	57	III. Oc.R.	27	0	11	I. Tr.I.
	21	01	II. Tr.I.		1	34	II. Sh.E.		21	30	I. Sh.I.		1	43	I. Sh.E.
	23	00	II. Sh.E.		2	39	II. Tr.E.		22	11	I. Tr.I.		2	29	I. Tr.E.
	23	12	I. Oc.R.		5	33	III. Oc.R.		23	49	I. Sh.E.		20	37	I. Ec.D.
	23	53	II. Tr.E.		19	36	I. Sh.I.	20	0	29	I. Tr.E.		22	36	II. Ec.D.
					20	10	I. Tr.I.		18	44	I. Ec.D.		23	41	I. Oc.R.
5	1	07	III. Oc.R.		21	55	I. Sh.E.		19	59	II. Ec.D.	28	3	06	II. Oc.R.
	17	42	I. Sh.I.		22	29	I. Tr.E.		21	42	I. Oc.R.		17	53	I. Sh.I.
	18	09	I. Tr.I.										18	41	I. Tr.I.
	20	00	I. Sh.E.	13	16	50	I. Ec.D.						20	11	I. Sh.E.
	20	28	I. Tr.E.		17	23	II. Ec.D.		15	59	I. Sh.I.		20	59	I. Tr.E.
					19	42	I. Oc.R.		16	41	I. Tr.I.				
6	14	46	II. Ec.D.		21	29	II. Oc.R.		18	17	I. Sh.E.	29	15	05	I. Ec.D.
	14	57	I. Ec.D.						18	59	I. Tr.E.		17	06	II. Sh.I.
	16	56	IV. Sh.I.	14	14	05	I. Sh.I.						18	11	I. Oc.R.
	17	42	I. Oc.R.		14	41	I. Tr.I.						18	42	II. Tr.I.
	18	39	II. Oc.R.		16	23	I. Sh.E.						19	57	II. Sh.E.
	21	21	IV. Tr.I.		16	59	I. Tr.E.	22	13	12	I. Ec.D.		21	32	II. Tr.E.
	21	44	IV. Sh.E.						15	57	II. Tr.I.		21	35	III. Sh.I.
									16	12	I. Oc.R.				
7	2	10	IV. Tr.E.	15	1	29	IV. Ec.D.		17	24	II. Sh.E.				
	12	11	I. Sh.I.		6	23	IV. Ec.R.		17	36	III. Sh.I.	30	0	52	III. Tr.I.
	12	40	I. Tr.I.		7	16	IV. Oc.D.		18	47	II. Tr.E.		1	13	III. Sh.E.
	14	29	I. Sh.E.		11	19	I. Ec.D.		20	29	III. Tr.I.		4	30	III. Tr.E.
	14	58	I. Tr.E.		12	00	II. Sh.I.		21	15	III. Sh.E.		12	21	I. Sh.I.
					12	12	IV. Oc.R.						13	10	I. Tr.I.
					13	11	II. Tr.I.						14	40	I. Sh.E.
8	9	25	I. Ec.D.		13	38	III. Sh.I.	23	0	08	III. Tr.E.		15	28	I. Tr.E.
	9	26	II. Sh.I.		14	12	I. Oc.R.		10	27	I. Sh.I.				
	9	39	III. Sh.I.		14	50	II. Sh.E.		10	55	IV. Sh.I.				
I. Sept. 15				II. Sept. 17				III. Sept. 19				IV. Sept. 15			
$x_1 = -1.5, y_1 = 0.0$				$x_1 = -1.9, y_1 = -0.1$				$x_1 = -2.5, y_1 = 0.0$				$x_1 = -3.3, y_1 = -0.1$ $x_2 = -1.3, y_2 = 0.0$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR SEPTEMBER

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I W	d •		E	III W	d •		E
II W	d •		E	IV W	d •	r • 	E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

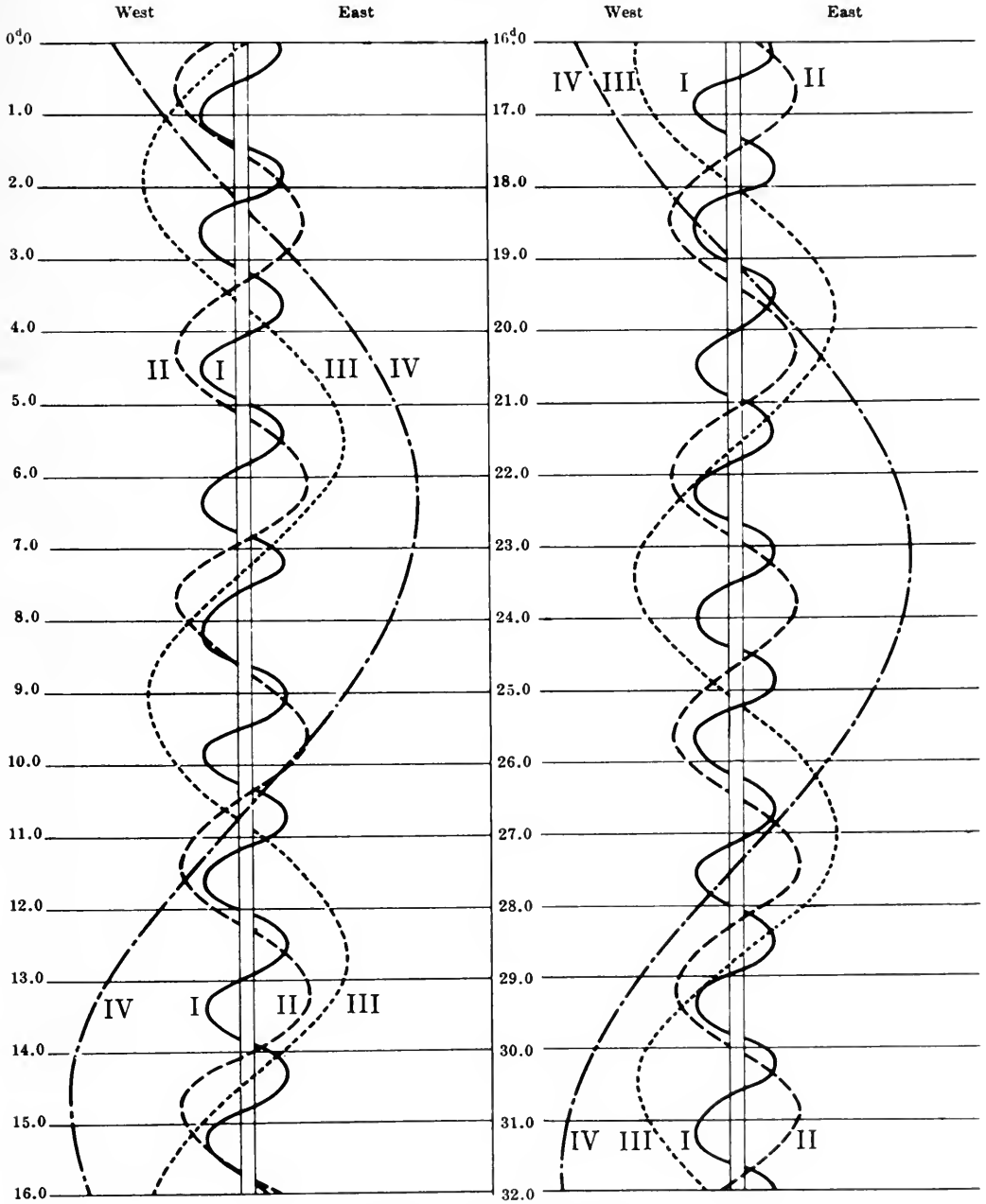
OCTOBER

d 1 11 12 16 19	h 9 54 40 30 29	m 34 11 40 30 29	I. Ec.D. II. Ec.D. I. Oc.R. II. Oc.R. IV. Ec.D.	d 9 11 11	h 9 02 57	m 40 02 57	I. Tr.I. I. Sh.E. I. Tr.E.	d 10 11 13 15 18 19 19 22	h 4 53 55 57 09 39 48 47 38 40 31 25 10 21 59	m 53 55 57 09 39 48 47 38 40 31 25 10 21 59	IV. Sh.I. I. Ec.D. II. Sh.I. I. Oc.R. IV. Sh.E. II. Tr.I. II. Sh.E. II. Tr.E. IV. Tr.I. III. Ec.D. IV. Tr.E. III. Ec.R. III. Oc.D. III. Oc.R.	d 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	h 3 13 09 30 27 23 02 38 48 40 41 39 59 05 57 52 08 13 09 04 59 32 09 09 31 09 17 09 27 09 26 13 20 37 06 03 10 38 11 38 55 38
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NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR OCTOBER

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I W	d •		E	III W	d •	r •		E
II W	d •		E	IV W	d •	r •		E

UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

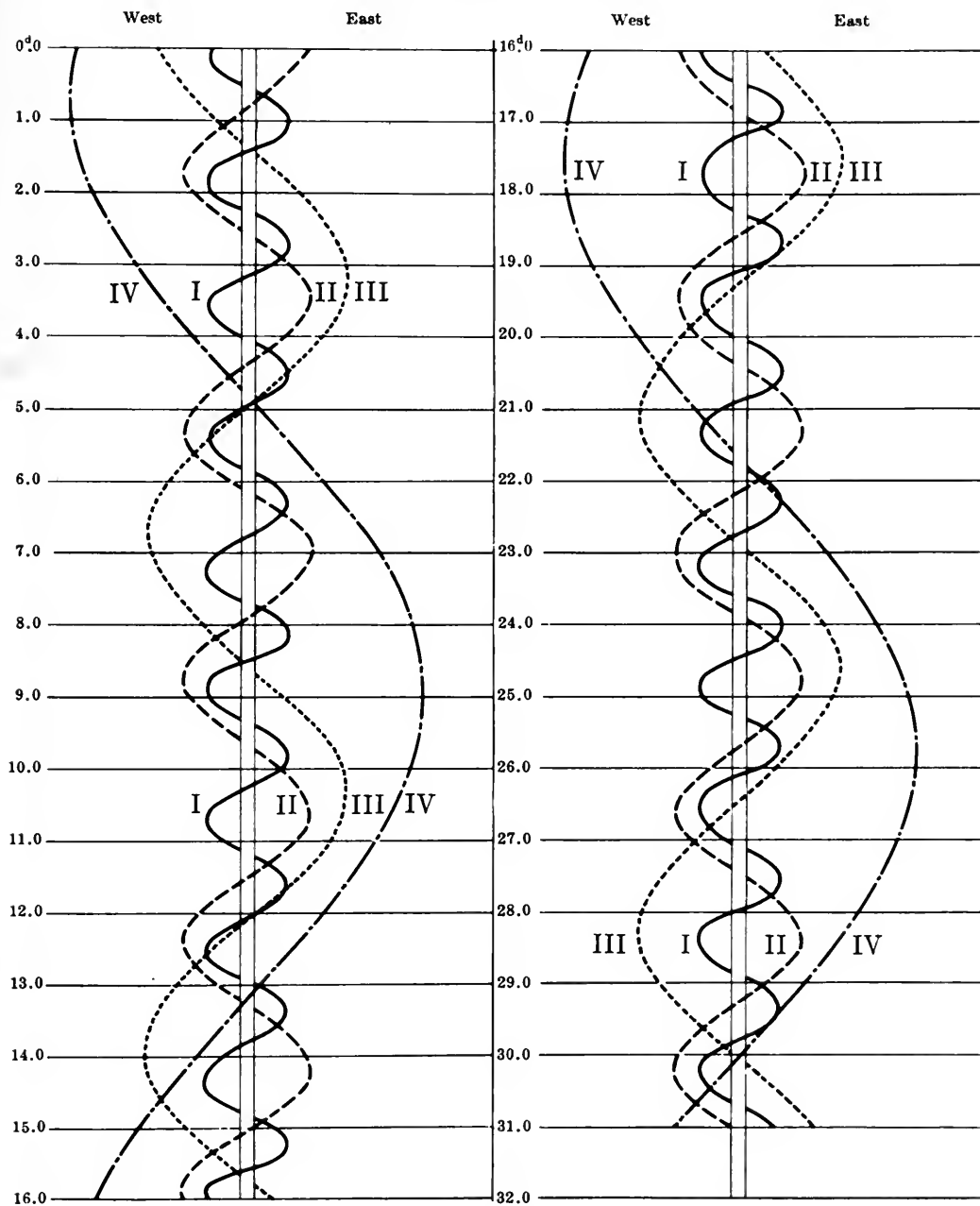
NOVEMBER

d	h	m		d	h	m		d	h	m		d	h	m	
1	3	24	III. Ec.D.	8	11	59	I. Tr.I.	15	16	20	III. Oc.D.	23	11	42	I. Ec.D.
	7	03	III. Ec.R.		12	14	III. Oc.D.		15	14	III. Oc.R.		15	14	I. Oc.R.
	8	05	III. Oc.D.		13	05	I. Sh.E.						19	21	II. Ec.D.
	8	54	I. Sh.I.		14	16	I. Tr.E.	16	9	49	I. Ec.D.		0	45	II. Oc.R.
	10	03	I. Tr.I.		15	50	III. Oc.R.		13	20	I. Oc.R.	24	9	03	I. Sh.I.
	11	11	I. Sh.E.						16	46	II. Ec.D.		10	18	I. Tr.I.
	11	41	III. Oc.R.	9	7	56	I. Ec.D.		22	08	II. Oc.R.		11	20	I. Sh.E.
	12	20	I. Tr.E.		11	25	I. Oc.R.						12	34	I. Tr.E.
					14	11	II. Ec.D.	17	7	10	I. Sh.I.				
2	6	03	I. Ec.D.		19	30	II. Oc.R.		8	23	I. Tr.I.		6	10	I. Ec.D.
	9	29	I. Oc.R.						9	27	I. Sh.E.	25	9	42	I. Oc.R.
	11	35	II. Ec.D.	10	5	16	I. Sh.I.		10	39	I. Tr.E.		13	34	II. Sh.I.
	16	50	II. Oc.R.		6	28	I. Tr.I.						16	03	II. Tr.I.
					7	33	I. Sh.E.	18	4	17	I. Ec.D.		16	24	II. Sh.E.
3	3	22	I. Sh.I.		8	45	I. Tr.E.		7	49	I. Oc.R.		18	52	II. Tr.E.
	4	32	I. Tr.I.						11	01	II. Sh.I.				
	5	40	I. Sh.E.	11	2	24	I. Ec.D.		13	28	II. Tr.I.	26	3	31	I. Sh.I.
	6	49	I. Tr.E.		5	54	I. Oc.R.		13	51	II. Sh.E.		4	46	I. Tr.I.
					8	27	II. Sh.I.		16	17	II. Tr.E.		5	20	III. Sh.I.
4	0	31	I. Ec.D.		10	51	II. Tr.I.						5	48	I. Sh.E.
	3	58	I. Oc.R.		11	17	II. Sh.E.	19	1	22	III. Sh.I.		7	02	I. Tr.E.
	5	54	II. Sh.I.		13	40	II. Tr.E.		1	38	I. Sh.I.		8	57	III. Sh.E.
	7	29	IV. Ec.D.		21	25	III. Sh.I.		2	52	I. Tr.I.		10	25	III. Tr.I.
	8	13	II. Tr.I.		23	44	I. Sh.I.		3	55	I. Sh.E.		13	58	III. Tr.E.
	8	44	II. Sh.E.						4	59	III. Sh.E.				
	11	02	II. Tr.E.	12	0	57	I. Tr.I.		5	08	I. Tr.E.				
	12	21	IV. Ec.R.		1	01	III. Sh.E.		6	24	III. Tr.I.	27	0	38	I. Ec.D.
	17	27	III. Sh.I.		2	01	I. Sh.E.		9	58	III. Tr.E.		4	11	I. Oc.R.
	18	52	IV. Oc.D.		2	20	III. Tr.I.		22	45	I. Ec.D.		8	39	II. Ec.D.
	21	04	III. Sh.E.		3	13	I. Tr.E.						14	02	II. Oc.R.
	21	51	I. Sh.I.		5	54	III. Tr.E.	20	2	17	I. Oc.R.		21	59	I. Sh.I.
	22	13	III. Tr.I.		16	48	IV. Sh.I.		6	04	II. Ec.D.		23	14	I. Tr.I.
	23	01	I. Tr.I.		20	52	I. Ec.D.		11	27	II. Oc.R.	28	0	16	I. Sh.E.
	23	35	IV. Oc.R.		21	31	IV. Sh.E.		20	06	I. Sh.I.		1	30	I. Tr.E.
									21	20	I. Tr.I.		19	07	I. Ec.D.
5	0	08	I. Sh.E.	13	0	23	I. Oc.R.		22	23	I. Sh.E.		22	39	I. Oc.R.
	1	18	I. Tr.E.		3	29	II. Ec.D.		23	37	I. Tr.E.				
	1	48	III. Tr.E.		4	15	IV. Tr.I.					29	2	51	II. Sh.I.
	18	59	I. Ec.D.		8	47	IV. Tr.E.	21	1	28	IV. Ec.D.		5	20	II. Tr.I.
	22	27	I. Oc.R.		8	50	II. Oc.R.		6	18	IV. Ec.R.		5	41	II. Sh.E.
					18	12	I. Sh.I.		13	34	IV. Oc.D.		8	09	II. Tr.E.
6	0	53	II. Ec.D.		19	25	I. Tr.I.		17	14	I. Ec.D.		10	45	IV. Sh.I.
	6	11	II. Oc.R.		20	30	I. Sh.E.		18	10	IV. Oc.R.		15	27	IV. Sh.E.
	16	19	I. Sh.I.		21	42	I. Tr.E.		20	46	I. Oc.R.		16	28	I. Sh.I.
	17	29	I. Tr.I.					22	0	18	II. Sh.I.		17	42	I. Tr.I.
	18	36	I. Sh.E.	14	15	20	I. Ec.D.		2	46	II. Tr.I.		18	45	I. Sh.E.
	19	47	I. Tr.E.		18	51	I. Oc.R.		3	07	II. Sh.E.		19	15	III. Ec.D.
					21	44	II. Sh.I.		5	34	II. Tr.E.		19	58	I. Tr.E.
7	13	27	I. Ec.D.						14	35	I. Sh.I.		22	29	IV. Tr.I.
	16	56	I. Oc.R.	15	0	10	II. Tr.I.		15	18	III. Ec.D.		22	53	III. Ec.R.
	19	10	II. Sh.I.		0	34	II. Sh.E.		15	49	I. Tr.I.	30	0	20	III. Oc.D.
	21	32	II. Tr.I.		2	58	II. Tr.E.		16	51	I. Sh.E.		2	55	IV. Tr.E.
	22	00	II. Sh.E.		11	20	III. Ec.D.		18	05	I. Tr.E.		3	54	III. Oc.R.
					12	41	I. Sh.I.		18	56	III. Ec.R.		13	35	I. Ec.D.
8	0	21	II. Tr.E.		13	54	I. Tr.I.		20	22	III. Oc.D.		17	07	I. Oc.R.
	7	22	III. Ec.D.		14	58	I. Sh.E.		23	57	III. Oc.R.		21	56	II. Ec.D.
	10	48	I. Sh.I.		14	59	III. Ec.R.								
	11	00	III. Ec.R.		16	11	I. Tr.E.								
I. Nov. 16				II. Nov. 16				III. Nov. 15				IV. Nov. 21			
$x_1 = -2.0, y_1 = 0.0$				$x_1 = -2.7, y_1 = -0.1$				$x_1 = -3.7, y_1 = -0.1$ $x_2 = -1.7, y_2 = -0.1$				$x_1 = -5.8, y_1 = -0.1$ $x_2 = -3.9, y_2 = -0.1$			

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR NOVEMBER

UNIVERSAL TIME



PHASES OF THE ECLIPSES

I	d		III	d	r		E
W	•		E	W	•		
II	d		IV	d	r		E
W	•		E	W	•		

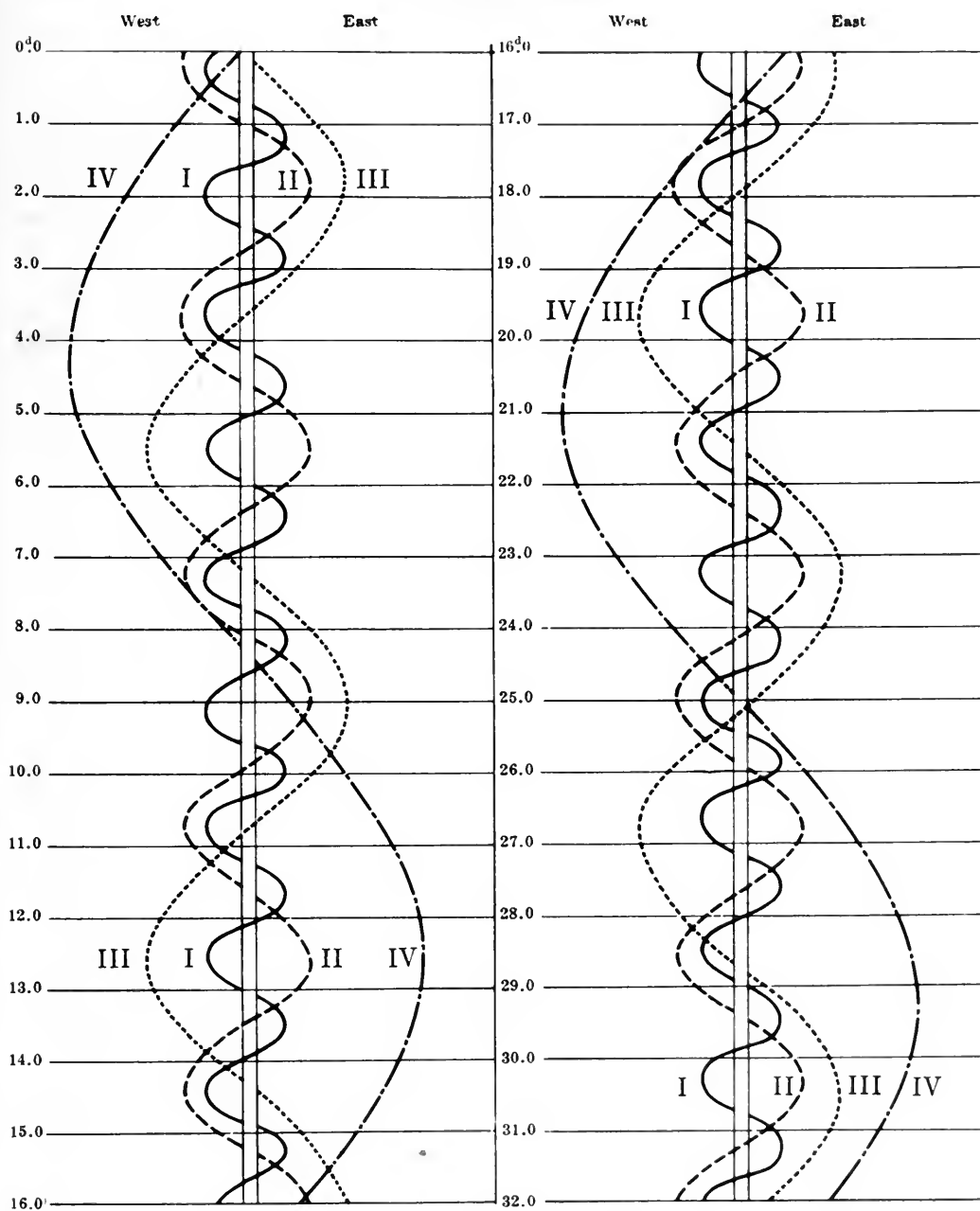
UNIVERSAL TIME OF GEOCENTRIC PHENOMENA

DECEMBER





d	h	m		d	h	m		d	h	m		d	h	m			
1	3	19	II. Oc.R.	9	9	56	I. Ec.D.	17	2	26	II. Tr.E.	25	0	47	III. Sh.E.		
	10	57	I. Sh.I.		13	27	I. Oc.R.		9	11	I. Sh.I.		1	43	III. Tr.I.		
	12	11	I. Tr.I.		18	42	II. Sh.I.		10	21	I. Tr.I.		4	42	IV. Oc.R.		
	13	13	I. Sh.E.		21	08	II. Tr.I.		11	28	I. Sh.E.		5	13	III. Tr.E.		
	14	27	I. Tr.E.		21	32	II. Sh.E.		12	37	I. Tr.E.		8	11	I. Ec.D.		
					23	57	II. Tr.E.		17	14	III. Sh.I.		11	35	I. Oc.R.		
2	8	03	I. Ec.D.						20	50	III. Sh.E.		18	58	II. Ec.D.		
	11	35	I. Oc.R.	10	7	18	I. Sh.I.		22	00	III. Tr.I.						
	16	08	II. Sh.I.		8	30	I. Tr.I.					26	0	01	II. Oc.R.		
	18	37	II. Tr.I.		9	35	I. Sh.E.	18	1	31	III. Tr.E.		5	33	I. Sh.I.		
	18	58	II. Sh.E.		10	46	I. Tr.E.		6	18	I. Ec.D.		6	38	I. Tr.I.		
	21	25	II. Tr.E.		13	16	III. Sh.I.		9	46	I. Oc.R.		7	50	I. Sh.E.		
					16	52	III. Sh.E.		16	24	II. Ec.D.		8	54	I. Tr.E.		
3	5	25	I. Sh.I.		18	13	III. Tr.I.		21	35	II. Oc.R.						
	6	38	I. Tr.I.		21	44	III. Tr.E.					27	2	39	I. Ec.D.		
	7	41	I. Sh.E.						19	3	40	I. Sh.I.		6	02	I. Oc.R.	
	8	55	I. Tr.E.	11	4	25	I. Ec.D.		4	49	I. Tr.I.		13	07	II. Sh.I.		
	9	18	III. Sh.I.		7	55	I. Oc.R.		5	56	I. Sh.E.		15	18	II. Tr.I.		
	12	54	III. Sh.E.		13	49	II. Ec.D.		7	05	I. Tr.E.		15	58	II. Sh.E.		
	14	21	III. Tr.I.		19	06	II. Oc.R.						18	06	II. Tr.E.		
	17	53	III. Tr.E.						20	0	46	I. Ec.D.					
					12	1	46	I. Sh.I.		4	13	I. Oc.R.	28	0	01	I. Sh.I.	
4	2	31	I. Ec.D.		2	58	I. Tr.I.		10	33	II. Sh.I.		1	05	I. Tr.I.		
	6	03	I. Oc.R.		4	03	I. Sh.E.		12	52	II. Tr.I.		2	18	I. Sh.E.		
	11	14	II. Ec.D.		5	14	I. Tr.E.		13	23	II. Sh.E.		3	21	I. Tr.E.		
	16	35	II. Oc.R.		22	53	I. Ec.D.		15	40	II. Tr.E.		11	06	III. Ec.D.		
	23	53	I. Sh.I.						22	08	I. Sh.I.		14	43	III. Ec.R.		
					13	2	23	I. Oc.R.	23	16	I. Tr.I.		15	28	III. Oc.D.		
5	1	07	I. Tr.I.		7	59	II. Sh.I.						19	00	III. Oc.R.		
	2	10	I. Sh.E.		10	23	II. Tr.I.		21	0	25	I. Sh.E.		21	08	I. Ec.D.	
	3	23	I. Tr.E.		10	49	II. Sh.E.		1	32	I. Tr.E.						
	21	00	I. Ec.D.		13	11	II. Tr.E.		7	08	III. Ec.D.	29	0	29	I. Oc.R.		
					20	15	I. Sh.I.		10	45	III. Ec.R.		8	15	II. Ec.D.		
6	0	31	I. Oc.R.		21	26	I. Tr.I.		11	48	III. Oc.D.		13	13	II. Oc.R.		
	5	25	II. Sh.I.		22	31	I. Sh.E.		15	20	III. Oc.R.		18	29	I. Sh.I.		
	7	53	II. Tr.I.		23	42	I. Tr.E.		19	14	I. Ec.D.		19	32	I. Tr.I.		
	8	15	II. Sh.E.						22	40	I. Oc.R.		20	46	I. Sh.E.		
	10	41	II. Tr.E.		14	3	10	III. Ec.D.					21	48	I. Tr.E.		
	18	21	I. Sh.I.		6	47	III. Ec.R.		22	5	41	II. Ec.D.					
	19	35	I. Tr.I.		8	03	III. Oc.D.		10	48	II. Oc.R.		30	15	36	I. Ec.D.	
	20	38	I. Sh.E.		11	35	III. Oc.R.		16	36	I. Sh.I.		18	56	I. Oc.R.		
	21	51	I. Tr.E.		17	21	I. Ec.D.		17	43	I. Tr.I.						
	23	12	III. Ec.D.		20	50	I. Oc.R.		18	53	I. Sh.E.		31	2	24	II. Sh.I.	
									19	59	I. Tr.E.		4	30	II. Tr.I.		
7	2	50	III. Ec.R.		15	3	06	II. Ec.D.					5	15	II. Sh.E.		
	4	13	III. Oc.D.		8	21	II. Oc.R.		23	13	43	I. Ec.D.		7	18	II. Tr.E.	
	7	47	III. Oc.R.		14	43	I. Sh.I.		17	08	I. Oc.R.		12	58	I. Sh.I.		
	15	28	I. Ec.D.		15	54	I. Tr.I.		23	50	II. Sh.I.		13	59	I. Tr.I.		
	18	59	I. Oc.R.		17	00	I. Sh.E.						15	14	I. Sh.E.		
	19	28	IV. Ec.D.		18	10	I. Tr.E.						16	15	I. Tr.E.		
									24	2	05	II. Tr.I.					
									2	40	II. Sh.E.						
8	0	17	IV. Ec.R.		16	4	41	IV. Sh.I.		4	53	II. Tr.E.		32	1	09	III. Sh.I.
	0	31	II. Ec.D.		9	21	IV. Sh.E.		11	04	I. Sh.I.			4	45	III. Sh.E.	
	5	51	II. Oc.R.		11	49	I. Ec.D.		12	11	I. Tr.I.			5	20	III. Tr.I.	
	7	26	IV. Oc.D.		15	18	I. Oc.R.		13	21	I. Sh.E.			8	50	III. Tr.E.	
	11	55	IV. Oc.R.		15	51	IV. Tr.I.		13	27	IV. Ec.D.			10	04	I. Ec.D.	
	12	50	I. Sh.I.		20	10	IV. Tr.E.		14	27	I. Tr.E.			13	23	I. Oc.R.	
	14	03	I. Tr.I.		21	16	II. Sh.I.		18	14	IV. Ec.R.			21	33	II. Ec.D.	
	15	06	I. Sh.E.		23	38	II. Tr.I.		21	11	III. Sh.I.			22	38	IV. Sh.I.	
	16	19	I. Tr.E.														
				17	0	06	II. Sh.E.		25	0	19	IV. Oc.D.					
I. Dec. 16				II. Dec. 15				III. Dec. 14				IV. Dec. 24					
$x_1 = -2.0, y_1 = 0.0$				$x_1 = -2.6, y_1 = -0.1$				$x_1 = -3.6, y_1 = -0.1$ $x_2 = -1.7, y_2 = -0.1$				$x_1 = -5.3, y_1 = -0.2$ $x_2 = -3.4, y_2 = -0.2$					

NOTE.—I. denotes ingress; E., egress; D., disappearance; R., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of the satellite; Sh., transit of the shadow.

CONFIGURATIONS OF SATELLITES I-IV FOR DECEMBER
UNIVERSAL TIME



PHASES OF THE ECLIPSES

<p>I W</p> <p>d</p> <p>•</p> 	<p>III E</p> <p>d</p> <p>•</p> <p>r</p> <p>•</p>  <p>E</p>
<p>II W</p> <p>d</p> <p>•</p> 	<p>IV E</p> <p>d</p> <p>•</p> <p>r</p> <p>•</p>  <p>E</p>

FOR 0^h UNIVERSAL TIME

Date	Axes of outer edge of outer ring		<i>U</i>	<i>B</i>	<i>P</i>	<i>U'</i>	<i>B'</i>	<i>P'</i>
	Major	Minor						
	"	"	°	°	°	°	°	°
Jan. - 2	38.68	0.19	226.260	-0.275	+4.583	190.401	-2.930	+27.588
2	38.43	0.27	226.462	0.397	4.565	190.521	2.989	27.577
6	38.18	0.35	226.685	0.529	4.546	190.641	3.049	27.565
10	37.94	0.44	226.929	0.672	4.524	190.761	3.109	27.554
14	37.72	0.54	227.193	0.825	4.501	190.881	3.169	27.542
18	37.50	0.65	227.477	-0.987	+4.476	191.001	-3.229	+27.530
22	37.30	0.75	227.778	1.158	4.450	191.121	3.289	27.517
26	37.10	0.87	228.096	1.337	4.422	191.241	3.349	27.505
30	36.92	0.98	228.430	1.523	4.392	191.361	3.409	27.493
Feb. 3	36.75	1.10	228.778	1.716	4.361	191.482	3.469	27.480
7	36.59	1.22	229.141	-1.916	+4.329	191.602	-3.529	+27.467
11	36.45	1.35	229.517	2.121	4.295	191.722	3.588	27.454
15	36.32	1.48	229.904	2.332	4.260	191.842	3.648	27.441
19	36.20	1.61	230.302	2.546	4.224	191.963	3.708	27.428
23	36.09	1.74	230.709	2.765	4.187	192.083	3.768	27.415
27	36.00	1.88	231.124	-2.986	+4.149	192.204	-3.828	+27.402
Mar. 3	35.92	2.01	231.547	3.210	4.111	192.324	3.888	27.388
7	35.86	2.15	231.977	3.436	4.071	192.445	3.948	27.374
11	35.81	2.29	232.411	3.664	4.031	192.566	4.008	27.361
15	35.77	2.43	232.850	3.892	3.990	192.686	4.068	27.347
19	35.75	2.57	233.292	-4.120	+3.949	192.807	-4.127	+27.333
23	35.74	2.71	233.735	4.348	3.908	192.928	4.187	27.318
27	35.75	2.85	234.180	4.575	3.866	193.049	4.247	27.304
31	35.76	2.99	234.624	4.800	3.824	193.170	4.307	27.290
Apr. 4	35.80	3.13	235.067	5.024	3.782	193.290	4.367	27.275
8	35.84	3.28	235.508	-5.244	+3.740	193.411	-4.427	+27.260
12	35.90	3.42	235.946	5.462	3.698	193.532	4.487	27.245
16	35.97	3.56	236.380	5.676	3.657	193.654	4.546	27.230
20	36.06	3.70	236.809	5.885	3.615	193.775	4.606	27.215
24	36.16	3.84	237.230	6.090	3.575	193.896	4.666	27.200
28	36.27	3.97	237.645	-6.290	+3.534	194.017	-4.726	+27.184
May 2	36.39	4.11	238.052	6.484	3.495	194.138	4.786	27.169
6	36.53	4.24	238.449	6.672	3.456	194.260	4.846	27.153
10	36.68	4.38	238.836	6.853	3.418	194.381	4.906	27.137
14	36.84	4.51	239.211	7.028	3.381	194.502	4.965	27.121
18	37.01	4.64	239.574	-7.194	+3.345	194.624	-5.025	+27.105
22	37.20	4.76	239.924	7.353	3.310	194.746	5.085	27.089
26	37.39	4.88	240.259	7.504	3.277	194.867	5.145	27.072
30	37.60	5.00	240.579	7.646	3.245	194.989	5.205	27.056
June 3	37.82	5.12	240.883	7.779	3.215	195.110	5.264	27.039
7	38.04	5.23	241.170	-7.902	+3.186	195.232	-5.324	+27.022
11	38.28	5.34	241.438	8.016	3.159	195.354	5.384	27.005
15	38.53	5.44	241.688	8.119	3.134	195.476	5.444	26.988
19	38.78	5.54	241.917	8.212	3.111	195.598	5.503	26.971
23	39.04	5.63	242.126	8.294	3.090	195.720	5.563	26.954
27	39.31	5.72	242.313	-8.366	+3.071	195.842	-5.623	+26.936
July 1	39.58	5.80	242.479	-8.426	+3.054	195.964	-5.683	+26.919

Factor by which axes of outer edge of outer ring are to be multiplied to obtain axes of:

Inner edge of outer ring 0.8801

Inner edge of inner ring 0.6650

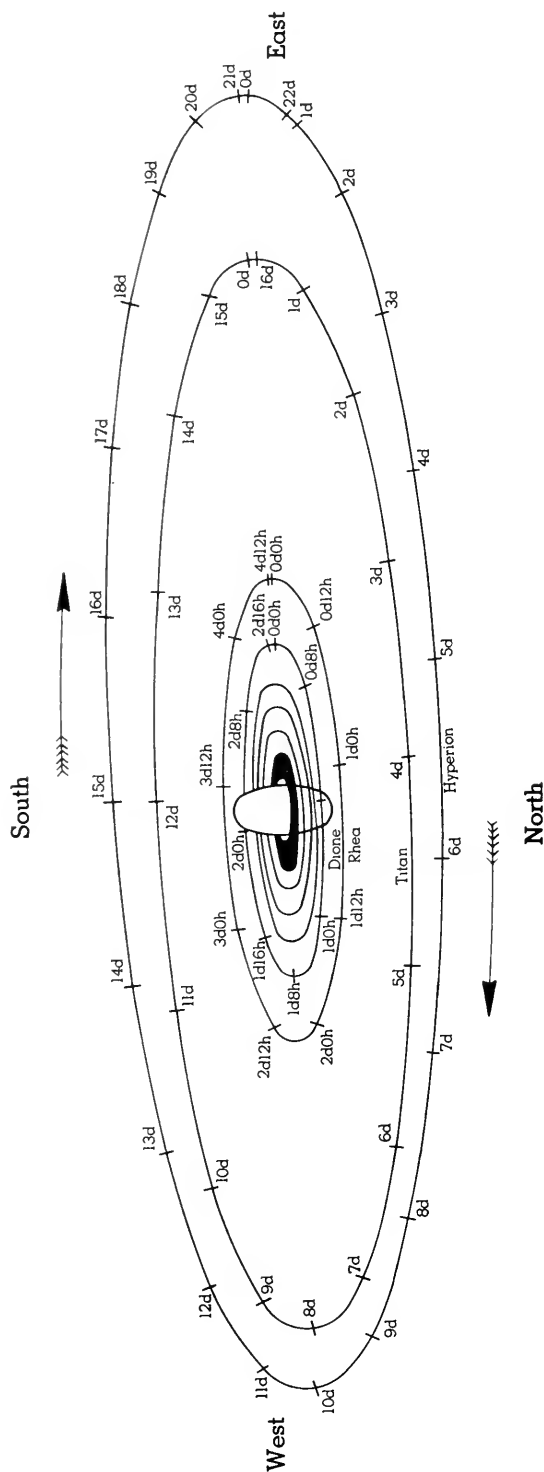
Outer edge of inner ring 0.8599

Inner edge of dusky ring 0.5486

FOR 0^h UNIVERSAL TIME

Date		Axes of outer edge of outer ring		<i>U</i>	<i>B</i>	<i>P</i>	<i>U'</i>	<i>B'</i>	<i>P'</i>
		Major	Minor						
July	1	"	"	°	°	°	°	°	°
	5	39.58	5.80	242.479	-8.426	+3.054	195.964	-5.683	+26.919
	9	39.86	5.87	242.621 ⁺¹⁴²	8.474	3.039	196.086	5.742	26.901
	13	40.15	5.94	242.740 ¹¹⁹	8.511	3.027	196.208	5.802	26.883
	17	40.43	6.00	242.835 ⁹⁵	8.536	3.017	196.331	5.862	26.865
		40.72	6.05	242.906 ⁷¹	8.549	3.010	196.453	5.921	26.847
				46					
	21	41.01	6.10	242.952	-8.551	+3.005	196.575	-5.981	+26.828
	25	41.29	6.13	242.973 ^{+ 21}	8.540	3.003	196.698	6.041	26.810
	29	41.58	6.16	242.969 ^{- 4}	8.518	3.003	196.820	6.100	26.791
Aug.	2	41.86	6.18	242.941 ²⁸	8.484	3.006	196.943	6.160	26.773
	6	42.13	6.18	242.888 ⁵³	8.439	3.012	197.065	6.219	26.754
			78						
	10	42.40	6.18	242.810	-8.382	+3.019	197.188	-6.279	+26.735
	14	42.66	6.17	242.709 ⁻¹⁰¹	8.315	3.030	197.311	6.339	26.716
	18	42.90	6.15	242.584 ¹²⁵	8.237	3.042	197.434	6.398	26.696
	22	43.14	6.11	242.438 ¹⁴⁶	8.150	3.057	197.556	6.458	26.677
	26	43.36	6.07	242.271 ¹⁶⁷	8.053	3.074	197.679	6.517	26.657
				187					
	30	43.56	6.02	242.084	-7.947	+3.093	197.802	-6.577	+26.638
	Sept. 3	43.74	5.96	241.878 ⁻²⁰⁶	7.833	3.113	197.925	6.636	26.618
	7	43.91	5.89	241.655 ²²³	7.712	3.136	198.049	6.696	26.598
	11	44.06	5.82	241.418 ²³⁷	7.585	3.160	198.172	6.755	26.578
15	44.18	5.73	241.167 ²⁵¹	7.453	3.185	198.295	6.815	26.557	
			261						
	19	44.28	5.64	240.906	-7.317	+3.211	198.418	-6.874	+26.537
	23	44.36	5.54	240.636 ⁻²⁷⁰	7.178	3.238	198.541	6.934	26.516
	27	44.41	5.44	240.359 ²⁷⁷	7.038	3.266	198.665	6.993	26.496
	Oct. 1	44.43	5.34	240.078 ²⁸¹	6.896	3.294	198.788	7.052	26.475
	5	44.43	5.23	239.795 ²⁸³	6.755	3.322	198.912	7.112	26.454
			283						
	9	44.41	5.12	239.512	-6.616	+3.350	199.035	-7.171	+26.433
	13	44.36	5.01	239.234 ⁻²⁷⁸	6.479	3.377	199.159	7.230	26.412
	17	44.28	4.90	238.961 ²⁷³	6.348	3.404	199.283	7.290	26.390
	21	44.18	4.79	238.696 ²⁶⁵	6.221	3.430	199.407	7.349	26.369
	25	44.05	4.68	238.441 ²⁵⁵	6.101	3.455	199.530	7.408	26.347
				243					
	29	43.90	4.58	238.198	-5.989	+3.479	199.654	-7.468	+26.325
	Nov. 2	43.74	4.48	237.970 ⁻²²⁸	5.885	3.501	199.778	7.527	26.303
	6	43.55	4.39	237.759 ²¹¹	5.791	3.522	199.902	7.586	26.281
	10	43.34	4.31	237.566 ¹⁹³	5.707	3.541	200.026	7.645	26.259
14	43.12	4.23	237.393 ¹⁷³	5.634	3.557	200.151	7.705	26.237	
			151						
	18	42.88	4.16	237.242	-5.573	+3.572	200.275	-7.764	+26.214
	22	42.63	4.10	237.113 ⁻¹²⁹	5.524	3.585	200.399	7.823	26.191
	26	42.37	4.05	237.007 ¹⁰⁶	5.487	3.595	200.524	7.882	26.169
	30	42.09	4.01	236.926 ⁸¹	5.464	3.603	200.648	7.941	26.146
	Dec. 4	41.82	3.97	236.870 ⁵⁶	5.453	3.608	200.772	8.000	26.123
				30					
	8	41.53	3.95	236.840	-5.457	+3.611	200.897	-8.059	+26.099
12	41.25	3.93	236.835 ^{- 5}	5.473	3.611	201.022	8.118	26.076	
16	40.96	3.93	236.857 ^{+ 22}	5.503	3.609	201.146	8.177	26.053	
20	40.67	3.93	236.905 ⁴⁸	5.546	3.605	201.271	8.236	26.029	
24	40.38	3.94	236.978 ⁷³	5.602	3.597	201.396	8.295	26.005	
			100						
	28	40.09	3.96	237.078	-5.671	+3.588	201.521	-8.354	+25.981
	32	39.81	3.99	237.202 ⁺¹²⁴	-5.753	+3.576	201.646	-8.413	+25.957

Factor by which axes of outer edge of outer ring are to be multiplied to obtain axes of:
 Inner edge of outer ring 0.8801 Inner edge of inner ring 0.6650
 Outer edge of inner ring 0.8599 Inner edge of dusky ring 0.5486



UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Jan.	Feb.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
MIMAS										
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
1 10.8	1 13.3	...	1 04.0	1 06.5	1 10.3	1 12.6	1 14.9	1 18.5	1 20.8	1 01.9
2 09.4	2 12.0	...	2 02.6	2 05.1	2 08.9	2 11.2	2 13.5	2 17.1	2 19.4	2 00.5
3 08.0	3 10.6	...	3 01.2	3 03.7	3 07.5	3 09.9	3 12.1	3 15.7	3 18.0	2 23.1
4 06.6	4 09.2	...	3 23.9	4 02.3	4 06.1	4 08.5	4 10.7	4 14.4	4 16.6	3 21.8
5 05.2	5 07.8	...	4 22.5	5 01.0	5 04.8	5 07.1	5 09.3	5 13.0	5 15.2	4 20.4
6 03.9	6 06.5	...	5 21.1	5 23.6	6 03.4	6 05.7	6 08.0	6 11.6	6 13.9	5 19.0
7 02.5	7 05.1	...	6 19.7	6 22.2	7 02.0	7 04.3	7 06.6	7 10.2	7 12.5	6 17.6
8 01.1	8 03.7	...	7 18.3	7 20.8	8 00.6	8 02.9	8 05.2	8 08.8	8 11.1	7 16.2
8 23.7	9 02.3	...	8 17.0	8 19.4	8 23.2	9 01.5	9 03.8	9 07.4	9 09.7	8 14.9
9 22.4	10 00.9	...	9 15.6	9 18.1	9 21.8	10 00.2	10 02.4	10 06.0	10 08.3	9 13.5
10 21.0	10 23.6	...	10 14.2	10 16.7	10 20.5	10 22.8	11 01.0	11 04.6	11 06.9	10 12.1
11 19.6	11 22.2	...	11 12.8	11 15.3	11 19.1	11 21.4	11 23.6	12 03.3	12 05.6	11 10.7
12 18.2	12 20.8	...	12 11.4	12 13.9	12 17.7	12 20.0	12 22.3	13 01.9	13 04.2	12 09.3
13 16.9	13 19.4	...	13 10.1	13 12.5	13 16.3	13 18.6	13 20.9	14 00.5	14 02.8	13 08.0
14 15.5	14 18.1	...	14 08.7	14 11.2	14 14.9	14 17.2	14 19.5	14 23.1	15 01.4	14 06.6
15 14.1	15 16.7	...	15 07.3	15 09.8	15 13.5	15 15.8	15 18.1	15 21.7	16 00.0	15 05.2
16 12.7	16 15.3	...	16 05.9	16 08.4	16 12.2	16 14.5	16 16.7	16 20.3	16 22.6	16 03.8
17 11.3	...	...	17 04.6	17 07.0	17 10.8	17 13.1	17 15.3	17 18.9	17 21.3	17 02.4
18 10.0	...	...	18 03.2	18 05.6	18 09.4	18 11.7	18 13.9	18 17.6	18 19.9	18 01.1
19 08.6	...	...	19 01.8	19 04.3	19 08.0	19 10.3	19 12.5	19 16.2	19 18.5	18 23.7
20 07.2	...	...	20 00.4	20 02.9	20 06.6	20 08.9	20 11.2	20 14.8	20 17.1	19 22.3
21 05.8	...	...	20 23.0	21 01.5	21 05.2	21 07.5	21 09.8	21 13.4	21 15.7	20 20.9
22 04.5	...	...	21 21.7	22 00.1	22 03.9	22 06.1	22 08.4	22 12.0	22 14.3	21 19.5
23 03.1	...	...	22 20.3	22 22.7	23 02.5	23 04.8	23 07.0	23 10.6	23 13.0	22 18.2
24 01.7	...	...	23 18.9	23 21.3	24 01.1	24 03.4	24 05.6	24 09.2	24 11.6	23 16.8
25 00.3	...	...	24 17.5	24 20.0	24 23.7	25 02.0	25 04.2	25 07.9	25 10.2	24 15.4
25 23.0	...	...	25 16.1	25 18.6	25 22.3	26 00.6	26 02.8	26 06.5	26 08.8	25 14.0
26 21.6	...	...	26 14.8	26 17.2	26 20.9	26 23.2	27 01.4	27 05.1	27 07.4	26 12.6
27 20.2	...	27 09.5	27 13.4	27 15.8	27 19.6	27 21.8	28 00.1	28 03.7	28 06.1	27 11.3
28 18.8	...	28 08.1	28 12.0	28 14.4	28 18.2	28 20.4	28 22.7	29 02.3	29 04.7	28 09.9
29 17.5	...	29 06.7	29 10.6	29 13.1	29 16.8	29 19.1	29 21.3	30 00.9	30 03.3	29 08.5
30 16.1	...	30 05.4	30 09.2	30 11.7	30 15.4	30 17.7	30 19.9	30 23.6	...	30 07.1
31 14.7	...	...	31 07.9	...	31 14.0	31 16.3	...	31 22.2	...	31 05.8

TETHYS

d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
1 14.4	2 16.9	...	2 11.6	1 16.8	1 21.8	1 02.8	2 04.8	2 09.4	1 14.1	1 19.0
3 11.7	4 14.3	...	4 08.9	3 14.1	3 19.2	3 00.1	4 02.1	4 06.7	3 11.4	3 16.3
5 09.0	6 11.6	...	6 06.2	5 11.4	5 16.5	4 21.4	5 23.4	6 04.0	5 08.7	5 13.6
7 06.3	8 08.9	...	8 03.6	7 08.7	7 13.8	6 18.7	7 20.7	8 01.3	7 06.0	7 10.9
9 03.7	10 06.3	...	10 00.9	9 06.1	9 11.1	8 16.0	9 18.0	9 22.6	9 03.3	9 08.2
11 01.0	12 03.6	...	11 22.2	11 03.4	11 08.4	10 13.3	11 15.3	11 19.9	11 00.6	11 05.5
12 22.3	14 00.9	...	13 19.5	13 00.7	13 05.7	12 10.5	13 12.5	13 17.2	12 21.9	13 02.8
14 19.6	15 22.3	...	15 16.9	14 22.0	15 03.0	14 07.8	15 09.8	15 14.5	14 19.2	15 00.1
16 17.0	...	...	17 14.2	16 19.3	17 00.3	16 05.1	17 07.1	17 11.8	16 16.5	16 21.5
18 14.3	...	...	19 11.5	18 16.6	18 21.6	18 02.4	19 04.4	19 09.1	18 13.8	18 18.8
20 11.6	...	...	21 08.8	20 14.0	20 18.9	19 23.7	21 01.7	21 06.4	20 11.1	20 16.1
22 08.9	...	...	23 06.2	22 11.3	22 16.2	21 21.0	22 23.0	23 03.7	22 08.4	22 13.4
24 06.3	...	...	25 03.5	24 08.6	24 13.5	23 18.3	24 20.3	25 01.0	24 05.7	24 10.7
26 03.6	...	...	27 00.8	26 05.9	26 10.8	25 15.6	26 17.6	26 22.2	26 03.0	26 08.0
28 00.9	...	28 16.9	28 22.1	28 03.2	28 08.1	27 12.9	28 14.9	28 19.5	28 00.4	28 05.4
29 22.3	...	30 14.2	30 19.5	30 00.5	30 05.4	29 10.2	30 12.2	30 16.8	29 21.7	30 02.7
31 19.6	...	...	...	...	...	31 07.5	...	...	...	32 00.0

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Jan.	Feb.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
ENCELADUS										
d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
1 06.1	1 18.7	...	1 21.1	1 00.8	1 04.4	1 16.7	2 04.9	2 08.2	1 11.5	1 14.9
2 15.0	3 03.6	...	3 06.0	2 09.7	2 13.3	3 01.6	3 13.8	3 17.1	2 20.4	2 23.8
3 23.9	4 12.5	...	4 14.9	3 18.6	3 22.1	4 10.5	4 22.7	5 02.0	4 05.3	4 08.7
5 08.8	5 21.4	...	5 23.8	5 03.5	5 07.0	5 19.4	6 07.6	6 10.8	5 14.2	5 17.6
6 17.7	7 06.3	...	7 08.7	6 12.4	6 15.9	7 04.2	7 16.4	7 19.7	6 23.0	7 02.5
8 02.6	8 15.2	...	8 17.6	7 21.3	8 00.8	8 13.1	9 01.3	9 04.6	8 07.9	8 11.4
9 11.5	10 00.1	...	10 02.5	9 06.2	9 09.7	9 22.0	10 10.2	10 13.5	9 16.8	9 20.3
10 20.3	11 09.0	...	11 11.4	10 15.0	10 18.6	11 06.9	11 19.1	11 22.3	11 01.7	11 05.2
12 05.2	12 17.9	...	12 20.3	11 23.9	12 03.5	12 15.8	13 03.9	13 07.2	12 10.6	12 14.0
13 14.1	14 02.8	...	14 05.2	13 08.8	13 12.3	14 00.6	14 12.8	14 16.1	13 19.5	13 22.9
14 23.0	15 11.7	...	15 14.1	14 17.7	14 21.2	15 09.5	15 21.7	16 01.0	15 04.3	15 07.8
16 07.9	16 20.6	...	16 23.0	16 02.6	16 06.1	16 18.4	17 06.6	17 09.9	16 13.2	16 16.7
17 16.8	...	...	18 07.9	17 11.5	17 15.0	18 03.3	18 15.4	18 18.7	17 22.1	18 01.6
19 01.7	...	...	19 16.8	18 20.4	18 23.9	19 12.1	20 00.3	20 03.6	19 07.0	19 10.5
20 10.6	...	...	21 01.7	20 05.3	20 08.8	20 21.0	21 09.2	21 12.5	20 15.9	20 19.4
21 19.5	...	...	22 10.6	21 14.2	21 17.7	22 05.9	22 18.1	22 21.4	22 00.8	22 04.3
23 04.4	...	...	23 19.4	22 23.0	23 02.5	23 14.8	24 02.9	24 06.2	23 09.6	23 13.2
24 13.3	...	...	25 04.3	24 07.9	24 11.4	24 23.7	25 11.8	25 15.1	24 18.5	24 22.1
25 22.2	...	...	26 13.2	25 16.8	25 20.3	26 08.5	26 20.7	27 00.0	26 03.4	26 06.9
27 07.1	...	27 18.4	27 22.1	27 01.7	27 05.2	27 17.4	28 05.6	28 08.9	27 12.3	27 15.8
28 16.0	...	29 03.3	29 07.0	28 10.6	28 14.1	29 02.3	29 14.5	29 17.8	28 21.2	29 00.7
30 00.9	...	30 12.2	30 15.9	29 19.5	29 22.9	30 11.2	30 23.3	31 02.6	30 06.1	30 09.6
31 09.8	...	...	...	...	31 07.8	31 20.0	...	...	...	31 18.5

DIONE

d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
2 05.6	1 08.6	...	2 18.0	1 21.0	1 23.8	1 02.3	2 22.3	3 00.5	2 02.7	2 05.1
4 23.3	4 02.3	...	5 11.7	4 14.7	4 17.4	3 20.0	5 15.9	5 18.1	4 20.3	4 22.8
7 17.0	6 20.1	...	8 05.4	7 08.4	7 11.1	6 13.7	8 09.6	8 11.8	7 14.0	7 16.4
10 10.8	9 13.8	...	10 23.2	10 02.1	10 04.8	9 07.3	11 03.3	11 05.4	10 07.7	10 10.1
13 04.5	12 07.5	...	13 16.9	12 19.8	12 22.5	12 01.0	13 20.9	13 23.1	13 01.3	13 03.8
15 22.2	15 01.3	...	16 10.6	15 13.5	15 16.2	14 18.7	16 14.6	16 16.7	15 19.0	15 21.5
18 15.9	...	...	19 04.4	18 07.2	18 09.9	17 12.3	19 08.2	19 10.4	18 12.7	18 15.2
21 09.7	...	...	21 22.1	21 00.9	21 03.6	20 06.0	22 01.9	22 04.0	21 06.3	21 08.9
24 03.4	...	...	24 15.8	23 18.6	23 21.3	22 23.7	24 19.5	24 21.7	24 00.0	24 02.6
26 21.1	...	27 06.5	27 09.5	26 12.4	26 15.0	25 17.3	27 13.2	27 15.3	26 17.7	26 20.3
29 14.9	...	30 00.2	30 03.2	29 06.1	29 08.6	28 11.0	30 06.8	30 09.0	29 11.4	29 14.0
						31 04.6				

RHEA

d h	d h	d h	d h	d h	d h	d h	d h	d h	d h	d h
5 03.9	1 07.1	...	2 18.4	3 10.1	5 01.5	1 04.1	1 18.7	3 09.0	3 23.3	1 01.6
9 16.5	5 19.7	...	7 06.9	7 22.6	9 14.0	5 16.5	6 07.0	7 21.3	8 11.7	5 14.0
14 05.0	10 08.2	...	11 19.5	12 11.1	14 02.4	10 04.8	10 19.3	12 09.6	13 00.0	10 02.4
18 17.5	14 20.8	...	16 08.0	16 23.6	18 14.8	14 17.2	15 07.7	16 21.9	17 12.4	14 14.9
23 06.0	...	...	20 20.6	21 12.1	23 03.3	19 05.6	19 20.0	21 10.3	22 00.8	19 03.3
27 18.6	...	...	25 09.1	26 00.6	27 15.7	23 18.0	24 08.3	25 22.6	26 13.2	23 15.8
		28 05.8	29 21.6	30 13.1		28 06.3	28 20.6	30 11.0		28 04.2

UNIVERSAL TIME OF CONJUNCTIONS AND ELONGATIONS

TITAN

Eastern Elongation		Inferior Conjunction		Western Elongation		Superior Conjunction	
d	h	d	h	d	h	d	h
Jan. 13	08.4	Jan. 1	13.6	Jan. 5	14.0	Jan. 9	09.0
Jan. 29	08.4	Jan. 17	13.4	Jan. 21	13.8	Jan. 25	08.9
Feb. 14	08.8	Feb. 2	13.6	Feb. 6	13.9	Feb. 10	09.1
.. ..	.. ..	.. ..	.. ..	Apr. 27	16.1	May 1	11.3
May 5	11.7	May 9	16.9	May 13	16.4	May 17	11.5
May 21	12.1	May 25	17.1	May 29	16.4	June 2	11.5
June 6	12.1	June 10	17.1	June 14	16.2	June 18	11.3
June 22	11.8	June 26	16.7	June 30	15.7	July 4	10.7
July 8	11.2	July 12	16.0	July 16	14.8	July 20	09.7
Aug. 24	10.1	Aug. 28	14.8	Aug. 1	13.5	Aug. 5	08.3
Aug. 9	08.6	Aug. 13	13.2	Aug. 17	11.8	Aug. 21	06.5
Aug. 25	06.7	Aug. 29	11.2	Sept. 2	09.8	Sept. 6	04.4
Sept. 10	04.4	Sept. 14	08.8	Sept. 18	07.5	Sept. 22	02.1
Sept. 26	02.0	Sept. 30	06.3	Oct. 4	05.1	Oct. 7	23.6
Oct. 11	23.4	Oct. 16	03.8	Oct. 20	02.7	Oct. 23	21.2
Oct. 27	21.0	Oct. 1	01.4	Nov. 5	00.4	Nov. 8	19.0
Nov. 12	18.8	Nov. 16	23.3	Nov. 20	22.4	Nov. 24	17.1
Nov. 28	16.9	Dec. 2	21.6	Dec. 6	20.9	Dec. 10	15.6
Dec. 14	15.5	Dec. 18	20.3	Dec. 22	19.7	Dec. 26	14.6
Dec. 30	14.6	Dec. 34	19.5				

HYPERION

Eastern Elongation		Inferior Conjunction		Western Elongation		Superior Conjunction	
d	h	d	h	d	h	d	h
Jan. 13	09.2	Jan. 19	16.1	Jan. 2	19.5	Jan. 7	06.6
Feb. 3	22.1	Feb. 10	04.0	Jan. 24	06.2	Jan. 28	18.1
May 1	03.6	May 7	03.3	Feb. 14	17.4	.. ..	.. ..
May 22	15.5	May 28	13.5	May 11	13.8	May 16	06.9
June 13	02.1	June 18	22.4	May 23	07.9	May 6	17.4
July 4	11.1	July 10	06.1	June 1	23.4	June 28	02.5
July 25	18.4	July 31	12.2	June 23	07.9	July 19	10.2
Aug. 15	23.9	Aug. 21	17.0	July 14	15.2	July 9	16.3
Sept. 6	03.9	Aug. 31	17.0	Aug. 4	21.1	Aug. 30	20.9
Sept. 27	06.7	Sept. 11	20.5	Aug. 26	01.8	Sept. 21	00.3
Oct. 18	08.9	Sept. 2	23.2	Sept. 16	05.3	Sept. 12	02.9
Nov. 8	11.4	Oct. 24	01.5	Oct. 7	08.1	Nov. 2	05.5
Nov. 29	14.5	Nov. 14	04.1	Oct. 28	10.7	Nov. 23	08.5
Dec. 20	18.8	Dec. 5	07.3	Nov. 18	13.4	Dec. 14	12.3
		Dec. 26	11.3	Dec. 9	16.7		
				Dec. 30	20.9		

IAPETUS

Eastern Elongation		Inferior Conjunction		Western Elongation		Superior Conjunction	
d	h	d	h	d	h	d	h
Feb. 15	06.7	.. ..	.. ..	Jan. 7	05.7	Jan. 26	20.1
May 7	17.2	May 28	18.2	.. ..	.. ..	.. ..	.. ..
July 27	02.1	Aug. 16	14.7	June 18	14.3	July 7	20.1
Oct. 13	11.6	Nov. 2	17.5	Sept. 5	20.6	Sept. 24	15.5
Dec. 31	08.3			Nov. 23	01.6	Dec. 12	03.4

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)	Mimas		Enceladus		Tethys		Dione	
	$\frac{a}{\Delta}$	p_1	$\frac{a}{\Delta}$	p_1	$\frac{a}{\Delta}$	p_1	$\frac{a}{\Delta}$	p_1
Jan. 0	"	°	"	°	"	°	"	°
5	26.3	+2.0	33.7	+1.6	41.7	+1.8	53.5	+1.6
10	26.1	1.8	33.4	1.5	41.4	1.8	53.0	1.5
15	25.9	1.6	33.2	1.5	41.1	1.8	52.6	1.5
20	25.7	1.5	32.9	1.5	40.8	1.8	52.2	1.5
25	25.5	1.3	32.7	1.5	40.5	1.8	51.9	1.4
25	25.3	+1.1	32.5	+1.4	40.2	+1.8	51.5	+1.4
May 10	25.0	-0.8	32.1	+0.4	39.7	+1.3	50.9	+0.4
15	25.1	0.7	32.3	0.4	39.9	1.2	51.1	0.4
20	25.3	0.7	32.4	0.3	40.2	1.2	51.4	0.3
25	25.5	-0.6	32.7	+0.3	40.4	+1.2	51.8	+0.3
30	25.6	0.5	32.9	0.2	40.7	1.2	52.1	0.2
June 4	25.8	0.5	33.1	0.2	41.0	1.1	52.5	0.2
9	26.0	0.4	33.4	0.2	41.3	1.1	52.9	0.2
14	26.2	0.3	33.6	0.1	41.6	1.1	53.3	0.1
19	26.4	-0.1	33.9	+0.1	42.0	+1.1	53.8	+0.1
24	26.7	0.0	34.2	+0.1	42.3	1.1	54.2	0.1
29	26.9	+0.1	34.5	0.0	42.7	1.0	54.7	+0.1
July 4	27.1	0.2	34.8	0.0	43.1	1.0	55.2	0.0
9	27.4	0.3	35.1	0.0	43.5	1.0	55.7	0.0
14	27.6	+0.4	35.4	0.0	43.9	+1.0	56.2	0.0
19	27.9	0.6	35.7	0.0	44.2	1.0	56.7	0.0
24	28.1	0.7	36.1	0.0	44.6	1.0	57.2	0.0
29	28.3	0.8	36.4	0.0	45.0	1.0	57.7	0.0
Aug. 3	28.5	0.9	36.7	0.0	45.4	1.0	58.1	0.0
8	28.8	+1.0	37.0	0.0	45.8	+1.1	58.6	0.0
13	29.0	1.1	37.3	0.0	46.1	1.1	59.1	0.0
18	29.2	1.2	37.5	0.0	46.5	1.1	59.5	0.0
23	29.4	1.3	37.7	0.0	46.8	1.1	59.9	+0.1
28	29.6	1.4	38.0	+0.1	47.1	1.1	60.3	0.1
Sept. 2	29.8	+1.5	38.2	+0.1	47.3	+1.2	60.6	+0.1
7	29.9	1.6	38.4	0.1	47.5	1.2	60.9	0.1
12	30.1	1.6	38.6	0.2	47.7	1.2	61.1	0.2
17	30.2	1.7	38.7	0.2	47.9	1.3	61.3	0.2
22	30.2	1.8	38.8	0.2	48.0	1.3	61.5	0.2
Oct. 27	30.3	+1.8	38.8	+0.3	48.1	+1.3	61.6	+0.3
2	30.3	1.8	38.9	0.3	48.1	1.4	61.6	0.3
7	30.3	1.9	38.9	0.3	48.1	1.4	61.6	0.3
12	30.2	1.9	38.8	0.4	48.0	1.5	61.5	0.4
17	30.2	1.9	38.7	0.4	47.9	1.5	61.4	0.4
22	30.1	+1.9	38.6	+0.4	47.8	+1.5	61.2	+0.4
27	30.0	1.8	38.5	0.5	47.6	1.6	61.0	0.5
Nov. 1	29.8	1.8	38.3	0.5	47.4	1.6	60.7	0.5
6	29.7	1.8	38.1	0.5	47.1	1.6	60.4	0.5
11	29.5	1.7	37.9	0.5	46.9	1.6	60.0	0.5
16	29.3	+1.7	37.6	+0.6	46.6	+1.7	59.6	+0.6
21	29.1	1.6	37.3	0.6	46.2	1.7	59.2	0.6
26	28.9	1.5	37.1	0.6	45.9	1.7	58.7	0.6
Dec. 1	28.7	1.3	36.8	0.6	45.5	1.7	58.3	0.6
6	28.4	1.2	36.4	0.6	45.1	1.7	57.8	0.6
11	28.2	+1.1	36.1	+0.6	44.7	+1.7	57.3	+0.6
16	27.9	1.0	35.8	0.6	44.3	1.7	56.8	0.6
21	27.7	0.9	35.5	0.6	44.0	1.7	56.3	0.6
26	27.4	0.7	35.2	0.6	43.6	1.7	55.8	0.6
31	27.2	0.6	34.9	0.6	43.2	1.7	55.3	0.6
36	27.0	+0.4	34.6	+0.6	42.8	+1.7	54.8	+0.6

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	Mimas		Time from Eastern Elongation	Enceladus		Tethys		Time from Eastern Elongation	Dione	
	F	p_1		F	p_1	F	p_1		F	p_1
h		°	d h		°		°	d h		°
0.0	1.000	93.0	0 00	1.000	93.0	1.000	93.0	0 00	1.000	93.0
0.5	0.991	92.0	0 01	0.982	91.7	0.991	92.1	0 02	0.982	91.7
1.0	0.962	91.0	0 02	0.929	90.3	0.962	91.1	0 04	0.929	90.3
1.5	0.916	89.9	0 03	0.843	88.6	0.916	90.1	0 06	0.842	88.6
2.0	0.852	88.7	0 04	0.727	86.5	0.852	88.9	0 08	0.726	86.5
2.5	0.772	87.2	0 05	0.585	83.4	0.773	87.5	0 10	0.585	83.4
3.0	0.678	85.4	0 06	0.426	78.2	0.679	85.7	0 12	0.425	78.2
3.5	0.572	82.9	0 07	0.259	66.4	0.573	83.4	0 14	0.257	66.2
4.0	0.457	79.3	0 08	0.126	22.6	0.457	79.9	0 16	0.126	21.7
4.5	0.336	73.0	0 09	0.189	311.5	0.336	73.9	0 18	0.191	311.1
5.0	0.217	59.6	0 10	0.352	291.6	0.216	61.1	0 20	0.354	291.5
5.5	0.128	22.5	0 11	0.517	284.5	0.124	24.4	0 22	0.519	284.4
6.0	0.154	324.5	0 12	0.667	280.7	0.149	324.1	1 00	0.669	280.7
6.5	0.261	299.8	0 13	0.795	278.3	0.256	299.2	1 02	0.797	278.2
7.0	0.382	290.2	0 14	0.895	276.4	0.378	289.6	1 04	0.896	276.4
7.5	0.502	285.1	0 15	0.963	274.9	0.498	284.7	1 06	0.964	274.9
8.0	0.614	282.0	0 16	0.996	273.6	0.611	281.7	1 08	0.997	273.6
8.5	0.716	279.8	0 17	0.994	272.3	0.713	279.6	1 10	0.994	272.2
9.0	0.805	278.2	0 18	0.957	270.9	0.802	278.0	1 12	0.955	270.9
9.5	0.878	276.8	0 19	0.885	269.4	0.876	276.7	1 14	0.883	269.3
10.0	0.936	275.6	0 20	0.781	267.5	0.934	275.6	1 16	0.778	267.4
10.5	0.975	274.6	0 21	0.651	264.9	0.974	274.6	1 18	0.647	264.9
11.0	0.996	273.6	0 22	0.498	260.9	0.996	273.6	1 20	0.494	260.8
11.5	0.999	272.6	0 23	0.332	253.1	0.999	272.7	1 22	0.327	252.7
12.0	0.982	271.7	1 00	0.173	229.9	0.983	271.8	2 00	0.169	228.6
12.5	0.947	270.6	1 01	0.135	154.6	0.948	270.8	2 02	0.138	152.4
13.0	0.893	269.5	1 02	0.278	117.5	0.896	269.7	2 04	0.283	117.0
13.5	0.823	268.2	1 03	0.445	107.0	0.827	268.4	2 06	0.451	106.8
14.0	0.738	266.6	1 04	0.603	102.1	0.742	266.9	2 08	0.608	102.0
14.5	0.639	264.6	1 05	0.741	99.2	0.643	265.0	2 10	0.746	99.2
15.0	0.529	261.7	1 06	0.854	97.2	0.534	262.3	2 12	0.858	97.1
15.5	0.411	257.3	1 07	0.937	95.6	0.415	258.2	2 14	0.939	95.5
16.0	0.289	249.2	1 08	0.986	94.2	0.293	250.6	2 16	0.987	94.1
16.5	0.176	229.9	1 09	1.000	92.9	0.178	232.7	2 18	1.000	92.8
17.0	0.122	178.2	1 10	0.978	91.5	0.116	181.7	2 20	0.976	91.5
17.5	0.191	131.9	1 11			0.182	132.2			
18.0	0.307	115.2	1 12			0.298	115.0			
18.5	0.428	107.9	1 13			0.420	107.6			
19.0	0.546	103.8	1 14			0.538	103.5			
19.5	0.654	101.1	1 15			0.647	100.9			
20.0	0.751	99.1	1 16			0.745	99.0			
20.5	0.835	97.6	1 17			0.829	97.5			
21.0	0.902	96.3	1 18			0.898	96.3			
21.5	0.953	95.2	1 19			0.950	95.2			
22.0	0.986	94.2	1 20			0.984	94.2			
22.5	0.999	93.2	1 21			0.999	93.3			
23.0	0.994	92.3	1 22			0.995	92.4			

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)	Rhea		Titan		Hyperion		Iapetus	
	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2	$\frac{a}{\Delta}$	p_2
	"	°	"	°	"	°	"	°
Jan. 0	74.7	+1.6	173	+1.2	209	+1.3	504	+2.4
5	74.1	1.6	172	1.2	208	1.3	500	2.4
10	73.5	1.5	170	1.2	206	1.3	496	2.3
15	72.9	1.4	169	1.2	205	1.3	493	2.2
20	72.4	1.4	168	1.1	203	1.2	489	2.1
25	71.9	+1.4	167	+1.1	202	+1.2	486	+2.0
May 10	71.0	+0.3	165	+0.1	199	+0.1	480	-0.2
15	71.4	0.2	165	0.0	200	0.0	482	0.3
20	71.8	0.2	166	0.0	202	0.0	485	0.3
25	72.3	+0.1	168	0.0	203	-0.1	488	-0.4
30	72.8	+0.1	169	-0.1	204	0.1	492	0.5
June 4	73.3	0.0	170	0.1	206	0.2	495	0.6
9	73.9	0.0	171	0.1	207	0.2	499	0.6
14	74.5	0.0	173	0.2	209	0.2	503	0.7
19	75.1	-0.1	174	-0.2	211	-0.3	507	-0.7
24	75.7	0.1	175	0.2	212	0.3	511	0.8
29	76.4	0.1	177	0.3	214	0.3	516	0.8
July 4	77.1	0.1	179	0.3	216	0.3	520	0.8
9	77.7	0.2	180	0.3	218	0.4	525	0.9
14	78.4	-0.2	182	-0.3	220	-0.4	530	-0.9
19	79.1	0.2	183	0.3	222	0.4	534	0.9
24	79.8	0.2	185	0.3	224	0.4	539	0.9
29	80.5	0.2	187	0.3	226	0.4	544	0.9
Aug. 3	81.2	0.2	188	0.3	228	0.4	548	0.9
8	81.8	-0.2	190	-0.3	230	-0.4	553	-0.9
13	82.5	0.2	191	0.3	231	0.4	557	0.9
18	83.1	0.1	193	0.3	233	0.3	561	0.8
23	83.6	0.1	194	0.3	235	0.3	565	0.8
28	84.1	0.1	195	0.2	236	0.3	568	0.8
Sept. 2	84.6	-0.1	196	-0.2	237	-0.3	571	-0.7
7	85.0	0.0	197	0.2	239	0.2	574	0.7
12	85.4	0.0	198	0.2	239	0.2	577	0.6
17	85.7	0.0	198	0.1	240	0.2	578	0.6
22	85.9	0.0	199	0.1	241	0.1	580	0.5
27	86.0	+0.1	199	-0.1	241	-0.1	581	-0.4
Oct. 2	86.0	0.1	199	0.0	241	-0.1	581	0.4
7	86.0	0.2	199	0.0	241	0.0	581	0.3
12	85.9	0.2	199	0.0	241	0.0	580	0.3
17	85.7	0.2	199	+0.1	241	0.0	579	0.2
22	85.5	+0.3	198	+0.1	240	+0.1	577	-0.1
27	85.2	0.3	197	0.1	239	0.1	575	-0.1
Nov. 1	84.8	0.3	196	0.2	238	0.1	573	0.0
6	84.3	0.3	195	0.2	237	0.2	569	0.0
11	83.8	0.4	194	0.2	235	0.2	566	+0.1
16	83.3	+0.4	193	+0.2	234	+0.2	562	+0.1
21	82.7	0.4	192	0.3	232	0.2	558	0.2
26	82.0	0.4	190	0.3	230	0.2	554	0.2
Dec. 1	81.4	0.4	189	0.3	228	0.3	550	0.2
6	80.7	0.4	187	0.3	226	0.3	545	0.2
11	80.0	+0.4	185	+0.3	224	+0.3	540	+0.2
16	79.3	0.4	184	0.3	222	0.3	536	0.2
21	78.6	0.4	182	0.3	221	0.3	531	0.2
26	77.9	0.4	181	0.3	219	0.2	526	0.2
31	77.2	0.4	179	0.2	217	0.2	522	0.1
36	76.6	+0.4	177	+0.2	215	+0.2	517	+0.1

APPARENT DISTANCE AND POSITION ANGLE

Time from Eastern Elongation	Rhea		Time from Eastern Elongation	Titan		Hyperion		Time from Eastern Elongation	Iapetus	
	F	p_1		F	p_1	F	p_1		F	p_1
d h		°	d h		°			d		°
0 00	1.000	93.0	0 00	1.022	93.0	1.103	93.0	0	1.001	79.0
0 03	0.985	91.8	0 10	1.013	91.9	1.092	92.3	2	0.993	77.3
0 06	0.941	90.4	0 20	0.978	90.8	1.069	91.5	4	0.962	75.6
0 09	0.869	88.9	1 06	0.919	89.6	1.033	90.7	6	0.908	73.7
0 12	0.772	87.1	1 16	0.839	88.1	0.986	89.8	8	0.834	71.5
0 15	0.652	84.6	2 02	0.738	86.4	0.926	88.8	10	0.741	68.8
0 18	0.515	80.9	2 12	0.620	83.9	0.855	87.7	12	0.633	65.3
0 21	0.366	74.3	2 22	0.488	80.3	0.773	86.4	14	0.513	60.2
1 00	0.217	58.6	3 08	0.347	73.7	0.682	84.7	16	0.389	51.8
1 03	0.125	5.8	3 18	0.209	58.3	0.582	82.4	18	0.270	35.7
1 06	0.207	309.4	4 04	0.121	8.3	0.474	79.2	20	0.194	2.3
1 09	0.355	292.3	4 14	0.191	311.4	0.362	74.0	22	0.218	318.9
1 12	0.505	285.4	5 00	0.327	293.4	0.250	64.1	24	0.318	294.0
1 15	0.643	281.6	5 10	0.467	286.1	0.152	40.0	26	0.441	282.1
1 18	0.764	279.1	5 20	0.600	282.2	0.126	346.0	28	0.564	275.4
1 21	0.863	277.2	6 06	0.718	279.6	0.202	308.3	30	0.679	271.1
2 00	0.937	275.7	6 16	0.817	277.7	0.311	294.1	32	0.781	268.0
2 03	0.983	274.3	7 02	0.895	276.2	0.422	287.3	34	0.866	265.5
2 06	1.000	273.1	7 12	0.948	274.9	0.529	283.3	36	0.932	263.4
2 09	0.987	271.8	7 22	0.974	273.7	0.627	280.6	38	0.976	261.6
2 12	0.945	270.5	8 08	0.973	272.5	0.712	278.6	40	0.997	259.9
2 15	0.875	269.0	8 18	0.945	271.3	0.783	277.0	42	0.993	258.2
2 18	0.780	267.2	9 04	0.889	269.9	0.838	275.6	44	0.965	256.5
2 21	0.661	264.8	9 14	0.808	268.4	0.875	274.4	46	0.914	254.6
3 00	0.525	261.2	10 00	0.703	266.5	0.893	273.3	48	0.840	252.5
3 03	0.376	255.0	10 10	0.580	263.8	0.893	272.2	50	0.745	249.8
3 06	0.227	240.3	10 20	0.442	259.4	0.874	271.0	52	0.632	246.3
3 09	0.126	191.3	11 06	0.294	250.9	0.838	269.6	54	0.506	241.1
3 12	0.198	131.5	11 16	0.159	226.4	0.785	268.4	56	0.373	232.3
3 15	0.344	113.0	12 02	0.130	156.5	0.718	266.9	58	0.249	214.2
3 18	0.495	105.8	12 12	0.250	120.0	0.638	264.9	60	0.179	173.7
3 21	0.634	101.8	12 22	0.397	108.8	0.548	262.4	62	0.230	129.0
4 00	0.756	99.2	13 08	0.540	103.6	0.449	258.7	64	0.350	108.0
4 03	0.857	97.3	13 18	0.671	100.6	0.346	253.0	66	0.483	98.1
4 06	0.933	95.8	14 04	0.785	98.5	0.245	242.4	68	0.611	92.5
4 09	0.981	94.4	14 14	0.879	96.9	0.158	218.7	70	0.726	88.8
4 12	1.000	93.2	15 00	0.951	95.5	0.133	171.2	72	0.825	86.0
4 15	0.989	91.9	15 10	0.998	94.4	0.196	134.8	74	0.903	83.8
			15 20	1.021	93.3	0.294	119.1	76	0.960	81.9
			16 06	1.011	91.9	0.398	111.5	78	0.992	80.1
			16 16			0.502	107.0	80	1.001	78.4
			17 02			0.601	104.1	82	0.985	76.8
			17 12			0.694	101.7			
			17 22			0.780	100.3			
			18 08			0.858	98.9			
			18 18			0.925	97.8			
			19 04			0.983	96.8			
			19 14			1.030	96.0			
			20 00			1.066	95.1			
			20 10			1.090	94.4			
			20 20			1.102	93.6			
			21 06			1.102	92.9			
			21 16			1.089	92.2			

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date		MIMAS			ENCELADUS		TETHYS		DIONE	
		<i>L</i>	<i>M</i>	θ	<i>L</i>	<i>M</i>	<i>L</i>	θ	<i>L</i>	<i>M</i>
		°	°	°	°	°	°	°	°	°
June	9	65.639	304.2	172.4	279.007	168.3	294.095	93.4	195.814	266.3
	14	175.660	49.2	167.4	152.661	40.3	167.582	92.4	133.488	203.6
	19	285.681	154.2	162.4	26.316	272.2	41.068	91.4	71.163	140.8
	24	35.702	259.3	157.4	259.970	144.2	274.555	90.5	8.837	78.1
	29	145.723	4.3	152.4	133.624	16.2	148.042	89.5	306.512	15.3
July	4	255.745	109.3	147.4	7.279	248.1	21.529	88.5	244.186	312.6
	9	5.766	214.3	142.4	240.933	120.1	255.016	87.5	181.861	249.8
	14	115.787	319.3	137.4	114.588	352.1	128.503	86.5	119.536	187.1
	19	225.808	64.3	132.4	348.242	224.0	1.989	85.5	57.210	124.3
	24	335.830	169.4	127.4	221.897	96.0	235.476	84.5	354.885	61.6
	29	85.851	274.4	122.4	95.552	328.0	108.963	83.5	292.559	358.8
Aug.	3	195.872	19.4	117.4	329.206	199.9	342.450	82.5	230.234	296.1
	8	305.894	124.4	112.4	202.861	71.9	215.937	81.5	167.908	233.4
	13	55.915	229.4	107.4	76.516	303.9	89.424	80.6	105.583	170.6
	18	165.937	334.4	102.4	310.171	175.8	322.910	79.6	43.257	107.9
	23	275.958	79.5	97.4	183.826	47.8	196.397	78.6	340.932	45.1
	28	25.980	184.5	92.4	57.481	279.8	69.884	77.6	278.606	342.4
Sept.	2	136.001	289.5	87.4	291.136	151.7	303.371	76.6	216.281	279.6
	7	246.023	34.5	82.4	164.791	23.7	176.858	75.6	153.955	216.9
	12	356.045	139.5	77.4	38.446	255.7	50.344	74.6	91.630	154.1
	17	106.066	244.6	72.4	272.101	127.6	283.831	73.6	29.304	91.4
	22	216.088	349.6	67.4	145.756	359.6	157.318	72.6	326.979	28.6
	27	326.110	94.6	62.4	19.412	231.6	30.805	71.6	264.653	325.9
Oct.	2	76.132	199.6	57.4	253.067	103.5	264.292	70.7	202.328	263.2
	7	186.153	304.6	52.4	126.723	335.5	137.778	69.7	140.002	200.4
	12	296.175	49.6	47.4	0.378	207.5	11.265	68.7	77.677	137.7
	17	46.197	154.7	42.4	234.034	79.4	244.752	67.7	15.351	74.9
	22	156.219	259.7	37.4	107.690	311.4	118.239	66.7	313.026	12.2
	27	266.241	4.7	32.4	341.346	183.4	351.726	65.7	250.700	309.4
Nov.	1	16.263	109.7	27.4	215.001	55.3	225.212	64.7	188.375	246.7
	6	126.285	214.7	22.4	88.657	287.3	98.699	63.7	126.049	183.9
	11	236.307	319.7	17.4	322.313	159.3	332.186	62.7	63.724	121.2
	16	346.329	64.8	12.4	195.970	31.2	205.673	61.8	1.398	58.4
	21	96.352	169.8	7.4	69.626	263.2	79.160	60.8	299.073	355.7
	26	206.374	274.8	2.4	303.282	135.2	312.646	59.8	236.747	292.9
Dec.	1	316.396	19.8	357.4	176.939	7.1	186.133	58.8	174.421	230.2
	6	66.418	124.8	352.4	50.595	239.1	59.620	57.8	112.096	167.5
	11	176.441	229.9	347.4	284.252	111.1	293.107	56.8	49.770	104.7
	16	286.463	334.9	342.4	157.908	343.0	166.594	55.8	347.445	42.0
	21	36.485	79.9	337.4	31.565	215.0	40.080	54.8	285.119	339.2
	26	146.508	184.9	332.4	265.222	87.0	273.567	53.8	222.793	276.5
	31	256.530	289.9	327.4	138.879	318.9	147.054	52.8	160.468	213.7
	36	6.553	34.9	322.4	12.536	190.9	20.540	51.9	98.142	151.0
5 ^d motion		1910.022	1905.0	-5.0	1313.6..	1312.0	953.487	-1.0	657.675	657.3

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date	RHEA				TITAN			
	<i>L</i>	<i>M</i>	θ	$\sin \gamma$	<i>L</i>	<i>M</i>	θ	$\sin \gamma$
	°	°	°		°	°	°	
June 9	60.032	214.4	302.3	0.00608	26.775	198.23	227.32	0.00563
14	98.482	252.8	302.2	.00608	139.659	311.11	227.32	.00563
19	136.932	291.3	302.1	.00608	252.544	63.99	227.31	.00563
24	175.382	329.8	301.9	.00608	5.428	176.86	227.31	.00563
29	213.832	8.2	301.8	.00608	118.312	289.74	227.30	.00563
July 4	252.282	46.7	301.6	0.00608	231.197	42.62	227.29	0.00563
9	290.731	85.1	301.5	.00608	344.081	155.50	227.29	.00563
14	329.181	123.6	301.4	.00609	96.966	268.38	227.28	.00563
19	7.631	162.1	301.2	.00609	209.850	21.25	227.28	.00564
24	46.081	200.5	301.1	.00609	322.735	134.13	227.27	.00564
29	84.531	239.0	301.0	0.00609	75.619	247.01	227.27	0.00564
Aug. 3	122.981	277.4	300.8	.00609	188.503	359.89	227.26	.00564
8	161.430	315.9	300.7	.00609	301.388	112.77	227.26	.00564
13	199.880	354.4	300.6	.00609	54.272	225.64	227.25	.00564
18	238.330	32.8	300.4	.00609	167.156	338.52	227.25	.00564
23	276.780	71.3	300.3	0.00610	280.041	91.40	227.24	0.00564
28	315.230	109.8	300.1	.00610	32.925	204.28	227.24	.00564
Sept. 2	353.680	148.2	300.0	.00610	145.810	317.16	227.23	.00564
7	32.129	186.7	299.9	.00610	258.694	70.04	227.23	.00564
12	70.579	225.1	299.7	.00610	11.579	182.91	227.22	.00565
17	109.029	263.6	299.6	0.00610	124.463	295.79	227.22	0.00565
22	147.479	302.1	299.5	.00610	237.348	48.67	227.21	.00565
27	185.929	340.5	299.3	.00610	350.232	161.55	227.21	.00565
Oct. 2	224.379	19.0	299.2	.00611	103.116	274.43	227.20	.00565
7	262.828	57.4	299.1	.00611	216.001	27.31	227.20	.00565
12	301.278	95.9	298.9	0.00611	328.885	140.18	227.20	0.00565
17	339.728	134.4	298.8	.00611	81.770	253.06	227.19	.00565
22	18.178	172.8	298.6	.00611	194.654	5.94	227.19	.00565
27	56.628	211.3	298.5	.00611	307.538	118.82	227.18	.00566
Nov. 1	95.078	249.8	298.4	.00611	60.423	231.70	227.18	.00566
6	133.527	288.2	298.2	0.00611	173.307	344.58	227.17	0.00566
11	171.977	326.7	298.1	.00612	286.192	97.45	227.17	.00566
16	210.427	5.1	298.0	.00612	39.076	210.33	227.16	.00566
21	248.877	43.6	297.8	.00612	151.961	323.21	227.16	.00566
26	287.327	82.1	297.7	.00612	264.845	76.09	227.16	.00566
Dec. 1	325.777	120.5	297.6	0.00612	17.729	188.97	227.15	0.00566
6	4.226	159.0	297.4	.00612	130.614	301.85	227.15	.00566
11	42.676	197.5	297.3	.00612	243.498	54.72	227.14	.00566
16	81.126	235.9	297.1	.00612	356.382	167.60	227.14	.00567
21	119.576	274.4	297.0	.00613	109.267	280.48	227.14	.00567
26	158.026	312.8	296.9	0.00613	222.151	33.36	227.13	0.00567
31	196.476	351.3	296.7	.00613	335.035	146.24	227.13	.00567
36	234.925	29.8	296.6	0.00613	87.920	259.11	227.12	0.00567
5 ^d motion	398.450	398.5	-0.01	. . . . .	112.884	112.88	0.00	. . . . .

ORBITAL POSITIONS FOR 0^h UNIVERSAL TIME

Date		HYPERION						IAPETUS		
		<i>L</i>	<i>M</i>	θ	γ	<i>e</i>	<i>a</i>	<i>L</i>	<i>M</i>	$\sin \gamma$
		°	°	°	°		"	°	°	
June	9	267.460	131.34	290.69	0.569	0.11652	2046.1	114.377	234.89	0.25831
	14	351.948	216.04	290.67	.569	.11624	2045.7	137.067	257.58	.25831
	19	76.457	300.77	290.65	.569	.11596	2045.4	159.756	280.27	.25831
	24	160.988	25.53	290.63	.569	.11567	2045.0	182.445	302.96	.25832
	29	245.541	110.30	290.60	.570	.11539	2044.7	205.135	325.65	.25832
July	4	330.115	195.10	290.58	0.570	0.11510	2044.3	227.824	348.33	0.25832
	9	54.711	279.92	290.56	.570	.11482	2044.0	250.514	11.02	.25833
	14	139.329	4.77	290.54	.570	.11453	2043.6	273.203	33.71	.25833
	19	223.969	89.64	290.52	.571	.11425	2043.3	295.892	56.40	.25833
	24	308.631	174.53	290.49	.571	.11396	2043.0	318.582	79.09	.25834
Aug.	29	33.314	259.44	290.47	0.571	0.11368	2042.6	341.271	101.78	0.25834
	3	118.018	344.38	290.45	.571	.11340	2042.3	3.961	124.46	.25834
	8	202.743	69.34	290.43	.572	.11312	2042.0	26.650	147.15	.25834
	13	287.490	154.33	290.41	.572	.11285	2041.6	49.339	169.84	.25835
	18	12.256	239.32	290.38	.572	.11258	2041.3	72.029	192.53	.25835
Sept.	23	97.043	324.35	290.36	0.572	0.11231	2041.0	94.718	215.22	0.25835
	28	181.850	49.39	290.34	.573	.11205	2040.7	117.407	237.90	.25836
	2	266.675	134.45	290.32	.573	.11179	2040.4	140.097	260.59	.25836
	7	351.519	219.54	290.30	.573	.11154	2040.1	162.786	283.28	.25836
	12	76.381	304.65	290.28	.574	.11129	2039.9	185.476	305.97	.25837
Oct.	17	161.260	29.77	290.25	0.574	0.11105	2039.6	208.165	328.66	0.25837
	22	246.156	114.91	290.23	.574	.11082	2039.3	230.854	351.34	.25837
	27	331.068	200.07	290.21	.574	.11059	2039.1	253.544	14.03	.25838
	2	55.995	285.24	290.19	.575	.11037	2038.9	276.233	36.72	.25838
	7	140.937	10.43	290.17	.575	.11015	2038.7	298.923	59.41	.25838
Nov.	12	225.892	95.63	290.14	0.575	0.10995	2038.5	321.612	82.10	0.25839
	17	310.860	180.85	290.12	.575	.10975	2038.3	344.301	104.79	.25839
	22	35.839	266.08	290.10	.576	.10956	2038.1	6.991	127.47	.25839
	27	120.830	351.32	290.08	.576	.10937	2038.0	29.680	150.16	.25840
	1	205.831	76.57	290.06	.576	.10920	2037.8	52.370	172.85	.25840
	6	290.841	161.83	290.03	0.576	0.10904	2037.7	75.059	195.54	0.25840
	11	15.858	247.10	290.01	.577	.10888	2037.6	97.748	218.23	.25841
	16	100.883	332.38	289.99	.577	.10873	2037.5	120.438	240.91	.25841
	21	185.914	57.67	289.97	.577	.10859	2037.4	143.127	263.60	.25841
	26	270.950	142.96	289.95	.577	.10846	2037.4	165.816	286.29	.25842
Dec.	1	355.990	228.25	289.93	0.578	0.10834	2037.3	188.506	308.98	0.25842
	6	81.033	313.55	289.91	.578	.10823	2037.3	211.195	331.67	.25842
	11	166.078	38.85	289.88	.578	.10813	2037.3	233.885	354.35	.25843
	16	251.123	124.15	289.86	.579	.10804	2037.3	256.574	17.04	.25843
	21	336.169	209.45	289.84	.579	.10795	2037.3	279.263	39.73	.25843
	26	61.213	294.75	289.82	0.579	0.10788	2037.4	301.953	62.42	0.25844
	31	146.254	20.05	289.80	.579	.10782	2037.4	324.642	85.11	.25844
	36	231.292	105.34	289.77	0.580	0.10776	2037.5	347.332	107.80	0.25844
5 ^d motion		... ..	... ..	... ..	... ..	... ..	... ..	22.689	22.69	... ..

DIFFERENTIAL COORDINATES OF HYPERION FOR 0^h UNIVERSAL TIME

Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$	Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$	Date	$\alpha_H - \alpha_{Sat.}$	$\delta_H - \delta_{Sat.}$
Jan. 0	^s - 7	['] +0.2	June 19	^s 0	['] +0.5	Sept. 25	^s +15	['] -0.5
2	-12	+0.2	21	- 8	+0.5	27	+18	-0.3
4	-11	+0.2	23	-12	+0.2	29	+16	0.0
6	- 5	0.0	25	-11	-0.2	Oct. 1	+ 9	+0.3
8	+ 3	-0.1	27	- 5	-0.5	3	0	+0.5
10	+10	-0.2	29	+ 4	-0.6	5	- 9	+0.5
12	+14	-0.3	July 1	+11	-0.6	7	-14	+0.2
14	+15	-0.3	3	+15	-0.4	9	-12	-0.1
16	+12	-0.2	5	+16	-0.1	11	- 5	-0.4
18	+ 6	0.0	7	+13	+0.2	13	+ 4	-0.5
20	- 1	+0.1	9	+ 6	+0.5	15	+12	-0.5
22	- 8	+0.2	11	- 3	+0.6	17	+17	-0.4
24	-12	+0.2	13	-11	+0.4	19	+17	-0.2
26	-10	+0.1	15	-13	+0.1	21	+13	+0.1
28	- 3	-0.1	17	- 9	-0.3	23	+ 5	+0.4
30	+ 5	-0.2	19	- 2	-0.6	25	- 4	+0.5
Feb. 1	+11	-0.3	21	+ 6	-0.6	27	-12	+0.4
3	+15	-0.3	23	+13	-0.5	29	-14	+0.1
5	+14	-0.2	25	+16	-0.3	31	- 9	-0.2
7	+11	-0.1	27	+16	0.0	Nov. 2	- 1	-0.4
9	+ 5	+0.1	29	+11	+0.3	4	+ 8	-0.5
11	- 3	+0.2	31	+ 2	+0.5	6	+14	-0.5
13	-10	+0.3	Aug. 2	- 7	-0.5	8	+17	-0.3
Apr. 30	+14	-0.3	4	-13	+0.3	10	+16	-0.1
May 2	+14	-0.1	6	-13	-0.1	12	+10	+0.2
4	+11	+0.1	8	- 7	-0.4	14	+ 1	+0.4
6	+ 5	+0.3	10	+ 1	-0.6	16	- 8	+0.4
8	- 3	+0.4	12	+ 9	-0.6	18	-14	+0.3
10	-10	+0.3	14	+15	-0.5	20	-12	0.0
12	-12	+0.1	16	+17	-0.2	22	- 6	-0.3
14	- 8	-0.2	18	+15	+0.1	24	+ 3	-0.4
16	- 1	-0.4	20	+ 8	+0.4	26	+11	-0.5
18	+ 6	-0.5	22	- 1	+0.6	28	+16	-0.4
20	+12	-0.4	24	-10	+0.5	30	-17	-0.2
22	+15	-0.3	26	-14	+0.2	Dec. 2	+13	0.0
24	+14	0.0	28	-11	-0.2	4	+ 6	+0.3
26	+10	-0.2	30	- 4	-0.5	6	- 3	+0.4
28	- 2	-0.4	Sept. 1	+ 5	-0.6	8	-11	+0.4
30	- 6	+0.5	3	+13	-0.6	10	-13	+0.2
June 1	-11	-0.3	5	+17	-0.4	12	-10	-0.1
3	-12	0.0	7	+17	-0.1	14	- 2	-0.4
5	- 7	-0.3	9	+13	+0.2	16	+ 6	-0.5
7	- 1	-0.5	11	+ 4	+0.5	18	+13	-0.4
9	+ 8	-0.6	13	- 5	+0.5	20	+16	-0.3
11	+14	-0.4	15	-13	+0.4	22	+15	-0.1
13	+15	-0.2	17	-14	0.0	24	+10	+0.1
15	+14	-0.1	19	- 9	-0.3	26	+ 2	+0.3
17	+ 8	-0.4	21	0	-0.5	28	- 7	-0.4
19	0	-0.5	23	- 9	-0.6	30	-12	-0.3
			25	+15	-0.5	32	-12	0.0

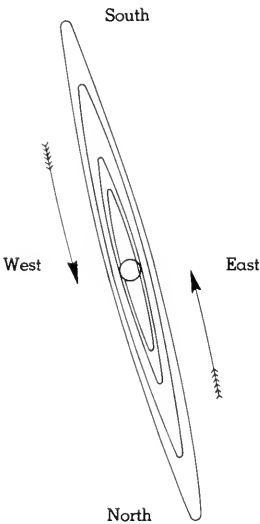
DIFFERENTIAL COORDINATES OF IAPETUS FOR 0^h UNIVERSAL TIME

Date	$\alpha_I - \alpha_{Sat.}$	$\delta_I - \delta_{Sat.}$	Date	$\alpha_I - \alpha_{Sat.}$	$\delta_I - \delta_{Sat.}$	Date	$\alpha_I - \alpha_{Sat.}$	$\delta_I - \delta_{Sat.}$
Jan. 0	-29 ^s	-0.5	June 19	-33 ^s	-1.8	Sept. 25	+ 2 ^s	-1.6
2	31	0.7	21	32	2.0	27	9	1.3
4	33	1.0	23	30	2.2	29	15	0.9
6	33	1.2	25	28	2.3	Oct. 1	20	0.5
8	33	1.3	27	25	2.4	3	25	-0.1
10	-32	-1.5	29	-21	-2.4	5	+29	+0.3
12	30	1.6	July 1	17	2.3	7	33	0.8
14	27	1.6	3	12	2.2	9	36	1.1
16	24	1.6	5	6	2.0	11	37	1.5
18	20	1.6	7	- 1	1.8	13	38	1.8
20	-16	-1.6	9	+ 5	-1.5	15	+38	+2.1
22	11	1.5	11	10	1.1	17	36	2.3
24	7	1.3	13	15	0.8	19	34	2.4
26	- 1	1.2	15	20	-0.4	21	31	2.5
28	+ 4	1.0	17	24	0.0	23	27	2.6
30	+ 9	-0.7	19	+28	+0.4	25	+23	+2.5
Feb. 1	13	0.5	21	31	0.8	27	18	2.4
3	18	-0.2	23	34	1.2	29	12	2.3
5	22	0.0	25	35	1.5	31	7	2.1
7	25	+0.3	27	35	1.9	Nov. 2	+ 1	1.8
9	+27	+0.6	29	+35	+2.1	4	- 5	+1.5
11	29	0.8	31	34	2.3	6	11	1.2
13	+31	+1.0	Aug. 2	32	2.5	8	16	0.8
15	..	..	4	29	2.6	10	21	0.5
Apr. 30	+26	+0.4	6	25	2.7	12	26	+0.1
May 2	+28	+0.7	8	+21	+2.6	14	-29	-0.3
4	30	1.0	10	16	2.5	16	32	0.7
6	31	1.3	12	11	2.4	18	35	1.0
8	31	1.6	14	+ 6	2.2	20	36	1.3
10	31	1.8	16	0	1.9	22	37	1.6
12	+30	+2.0	18	- 5	+1.6	24	-36	-1.8
14	28	2.1	20	11	1.3	26	35	2.0
16	25	2.2	22	16	0.9	28	32	2.2
18	22	2.2	24	21	0.5	30	29	2.3
20	19	2.2	26	26	+0.1	Dec. 2	26	2.3
22	+14	+2.2	28	-30	-0.3	4	-21	-2.2
24	10	2.1	30	33	0.7	6	16	2.1
26	5	1.9	Sept. 1	35	1.1	8	11	2.0
28	+ 1	1.7	3	37	1.5	10	- 5	1.8
30	- 4	1.4	5	37	1.8	12	+ 1	1.5
June 1	- 9	+1.2	7	-37	-2.1	14	+ 6	-1.2
3	14	0.9	9	36	2.3	16	12	0.9
5	18	0.5	11	33	2.5	18	17	0.5
7	22	+0.2	13	30	2.5	20	22	-0.2
9	25	-0.2	15	26	2.6	22	26	+0.2
11	-28	-0.5	17	-21	-2.5	24	+29	+0.5
13	31	0.9	19	16	2.4	26	31	0.9
15	32	1.2	21	10	2.2	28	33	1.2
17	33	1.5	23	- 4	2.0	30	34	1.5
19	-33	-1.8	25	+ 2	-1.6	32	+34	+1.7

DIFFERENTIAL COORDINATES OF PHOEBE FOR 0^h UNIVERSAL TIME

Date	$\alpha_{Ph.} - \alpha_{Sat.}$	$\delta_{Ph.} - \delta_{Sat.}$	Date	$\alpha_{Ph.} - \alpha_{Sat.}$	$\delta_{Ph.} - \delta_{Sat.}$	Date	$\alpha_{Ph.} - \alpha_{Sat.}$	$\delta_{Ph.} - \delta_{Sat.}$
	m s	'		m s	'		m s	'
Jan. 0	+0 25	+ 5.3	June 19	+1 58	+13.3	Sept. 25	+0 36	+ 2.4
2	0 28	5.6	21	1 57	13.1	27	0 34	2.1
4	0 31	5.9	23	1 56	13.0	29	0 31	1.8
6	0 33	6.2	25	1 55	12.9	Oct. 1	0 29	1.5
8	0 36	6.4	27	1 54	12.7	3	0 26	1.2
10	+0 38	+ 6.7	29	+1 53	+12.6	5	+0 24	+ 0.9
12	0 41	7.0	July 1	1 52	12.4	7	0 21	0.6
14	0 43	7.3	3	1 51	12.3	9	0 19	+ 0.2
16	0 46	7.5	5	1 50	12.1	11	0 16	- 0.1
18	0 48	7.8	7	1 49	12.0	13	0 13	0.4
20	+0 51	+ 8.0	9	+1 48	+11.8	15	+0 11	- 0.7
22	0 53	8.3	11	1 47	11.6	17	0 08	1.0
24	0 55	8.5	13	1 46	11.5	19	0 06	1.3
26	0 58	8.8	15	1 44	11.3	21	0 03	1.6
28	1 00	9.0	17	1 43	11.1	23	+0 01	1.9
30	+1 02	+ 9.3	19	+1 42	+10.9	25	-0 02	- 2.2
Feb. 1	1 04	9.5	21	1 40	10.7	27	0 05	2.5
3	1 07	9.7	23	1 39	10.5	29	0 07	2.8
5	1 09	9.9	25	1 38	10.3	31	0 10	3.1
7	1 11	10.2	27	1 36	10.1	Nov. 2	0 12	3.4
9	+1 13	+10.4	29	+1 35	+ 9.9	4	-0 15	- 3.7
11	1 15	10.6	31	1 33	9.7	6	0 18	4.0
13	+1 17	+10.8	Aug. 2	1 31	9.5	8	0 20	4.3
Apr. 30	+2 03	+14.8	4	1 30	9.3	10	0 23	4.6
May 2	+2 03	+14.8	6	1 28	9.0	12	0 25	4.9
4	2 03	14.8	8	+1 26	+ 8.8	14	-0 28	- 5.2
6	2 04	14.8	10	1 25	8.6	16	0 30	5.5
8	2 04	14.8	12	1 23	8.4	18	0 33	5.7
10	2 04	14.7	14	1 21	8.1	20	0 35	6.0
12	+2 04	+14.7	16	1 19	7.9	22	0 38	6.3
14	2 04	14.7	18	+1 17	+ 7.6	24	-0 40	- 6.5
16	2 04	14.7	20	1 15	7.4	26	0 42	6.8
18	2 04	14.6	22	1 13	7.1	28	0 45	7.1
20	2 04	14.6	24	1 11	6.9	30	0 47	7.3
22	+2 04	+14.5	26	1 09	6.6	Dec. 2	0 49	7.5
24	2 04	14.5	28	+1 07	+ 6.3	4	-0 52	- 7.8
26	2 04	14.4	30	1 05	6.1	6	0 54	8.0
28	2 03	14.3	Sept. 1	1 03	5.8	8	0 56	8.2
30	2 03	14.3	3	1 01	5.5	10	0 58	8.4
June 1	+2 03	+14.2	5	0 59	5.3	12	1 00	8.6
3	2 02	14.1	7	+0 57	+ 5.0	14	-1 02	- 8.8
5	2 02	14.0	9	0 55	4.7	16	1 04	9.0
7	2 01	13.9	11	0 52	4.4	18	1 06	9.2
9	2 01	13.8	13	0 50	4.1	20	1 08	9.4
11	+2 00	+13.7	15	0 48	3.9	22	1 10	9.6
13	2 00	13.6	17	+0 45	+ 3.6	24	-1 11	- 9.7
15	1 59	13.5	19	0 43	3.3	26	1 13	9.9
17	1 58	13.4	21	0 41	3.0	28	1 15	10.0
19	+1 58	+13.3	23	0 38	2.7	30	1 16	10.1
			25	+0 36	+ 2.4	32	-1 17	-10.3

APPARENT ORBITS OF SATELLITES I-IV AT DATE OF OPPOSITION,
MARCH 13



NAME		SIDEREAL PERIOD	
		d	h
V	Miranda	1.4	
I	Ariel	2	12.489
II	Umbriel	4	03.460
III	Titania	8	16.941
IV	Oberon	13	11.118

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)		$\frac{a}{\Delta}$				p_2	Date (0 ^h U.T.)		$\frac{a}{\Delta}$				p_2
		Ariel	Umbriel	Titania	Oberon				Ariel	Umbriel	Titania	Oberon	
Jan.	0	"	"	"	"	°	June	9	"	"	"	"	°
	10	14.7	20.4	33.5	44.9	+0.5		19	14.5	20.2	33.2	44.4	+0.3
	20	14.8	20.6	33.9	45.3	0.5		29	14.4	20.0	32.9	44.0	0.3
	30	14.9	20.8	34.1	45.7	0.5		9	14.3	19.9	32.6	43.6	0.3
Feb.	9	15.0	21.0	34.4	46.0	0.5	July	19	14.1	19.7	32.3	43.2	0.3
	19	15.1	21.1	34.6	46.3	0.4		29	14.0	19.6	32.1	42.9	0.3
Mar.	19	15.2	21.2	34.8	46.5	+0.4	Oct.	17	13.9	19.4	31.9	42.6	+0.3
	1	15.3	21.3	34.9	46.7	0.4		27	13.8	19.2	31.5	42.1	+0.5
	11	15.3	21.3	34.9	46.7	0.4		6	13.9	19.3	31.7	42.3	0.5
	21	15.3	21.3	34.9	46.7	0.4		16	13.9	19.4	31.9	42.6	0.5
Apr.	31	15.3	21.3	34.9	46.6	0.3	Dec.	16	14.0	19.6	32.1	42.9	+0.5
	10	15.2	21.2	34.7	46.5	+0.3		26	14.2	19.7	32.4	43.3	0.5
	20	15.1	21.1	34.6	46.2	0.3		6	14.3	19.9	32.6	43.6	0.5
	30	15.0	20.9	34.3	45.9	0.3		16	14.4	20.1	32.9	44.0	0.5
May	10	14.9	20.8	34.1	45.6	0.3		26	14.5	20.3	33.2	44.4	0.5
	20	14.8	20.6	33.8	45.2	0.3		36	14.7	20.4	33.5	44.9	+0.5
	30	14.7	20.4	33.5	44.8	+0.3							

APPARENT DISTANCE AND POSITION ANGLE

Time from Northern Elongation	Ariel		Umbriel		Time from Northern Elongation	Titania		Time from Northern Elongation	Oberon	
	<i>F</i>	<i>p₁</i>	<i>F</i>	<i>p₁</i>		<i>F</i>	<i>p₁</i>		<i>F</i>	<i>p₁</i>
d h		°		°	d h		°	d h		°
0 00	1.000	15.0	1.000	15.0	0 00	1.000	15.0	0 00	1.000	15.0
0 02	0.979	16.1	0.992	15.7	0 05	0.989	15.8	0 08	0.988	15.8
0 04	0.916	17.3	0.969	16.3	0 10	0.955	16.6	0 16	0.952	16.7
0 06	0.814	18.7	0.930	17.0	0 15	0.901	17.5	1 00	0.894	17.6
0 08	0.677	20.6	0.876	17.8	0 20	0.826	18.5	1 08	0.814	18.7
0 10	0.513	23.7	0.809	18.8	1 01	0.733	19.8	1 16	0.715	20.1
0 12	0.330	30.0	0.729	19.9	1 06	0.624	21.5	2 00	0.600	21.9
0 14	0.147	52.5	0.637	21.3	1 11	0.502	24.0	2 08	0.470	24.7
0 16	0.128	150.5	0.537	23.2	1 16	0.369	28.1	2 16	0.332	29.9
0 18	0.307	178.7	0.428	26.0	1 21	0.233	37.1	3 00	0.191	42.5
0 20	0.492	185.8	0.314	30.8	2 02	0.112	68.2	3 08	0.091	95.4
0 22	0.659	189.1	0.200	41.2	2 07	0.122	147.8	3 16	0.166	162.5
1 00	0.799	191.1	0.105	73.7	2 12	0.247	174.3	4 00	0.304	178.6
1 02	0.905	192.6	0.115	143.6	2 17	0.384	182.5	4 08	0.444	184.5
1 04	0.973	193.8	0.216	170.9	2 22	0.515	186.4	4 16	0.575	187.6
1 06	1.000	194.9	0.330	180.0	3 03	0.636	188.7	5 00	0.694	189.6
1 08	0.984	195.9	0.443	184.5	3 08	0.744	190.3	5 08	0.796	191.1
1 10	0.925	197.1	0.551	187.1	3 13	0.835	191.6	5 16	0.880	192.2
1 12	0.828	198.5	0.650	188.9	3 18	0.908	192.6	6 00	0.943	193.2
1 14	0.696	200.3	0.740	190.3	3 23	0.960	193.5	6 08	0.983	194.0
1 16	0.535	203.2	0.819	191.4	4 04	0.991	194.3	6 16	1.000	194.8
1 18	0.353	208.8	0.884	192.3	4 09	1.000	195.1	7 00	0.992	195.6
1 20	0.167	227.2	0.936	193.1	4 14	0.986	195.9	7 08	0.961	196.5
1 22	0.111	321.3	0.973	193.8	4 19	0.951	196.7	7 16	0.907	197.4
2 00	0.284	257.2	0.994	194.4	5 00	0.894	197.6	8 00	0.831	198.5
2 02	0.470	5.2	1.000	195.1	5 05	0.817	198.7	8 08	0.736	199.8
2 04	0.640	8.8	0.990	195.7	5 10	0.722	200.0	8 16	0.623	201.5
2 06	0.783	10.9	0.964	196.4	5 15	0.612	201.7	9 00	0.496	204.1
2 08	0.894	12.4	0.923	197.2	5 20	0.488	204.4	9 08	0.359	208.6
2 10	0.967	13.6	0.868	198.0	6 01	0.355	208.7	9 16	0.218	218.8
2 12	0.999	14.7	0.799	198.9	6 06	0.219	218.7	10 00	0.100	258.0
2 14	0.988	15.8	0.717	200.0	6 11	0.103	255.2	10 08	0.141	335.9
2 16			0.624	201.5	6 16	0.133	332.9	10 16	0.276	356.7
2 18			0.522	203.5	6 21	0.262	355.6	11 00	0.417	3.7
2 20			0.413	206.5	7 02	0.398	3.0	11 08	0.550	7.1
2 22			0.299	211.7	7 07	0.528	6.7	11 16	0.672	9.3
3 00			0.186	223.5	7 12	0.648	8.9	12 00	0.778	10.8
3 02			0.097	262.3	7 17	0.754	10.5	12 08	0.865	12.0
3 04			0.126	329.7	7 22	0.844	11.7	12 16	0.932	13.0
3 06			0.231	352.6	8 03	0.914	12.7	13 00	0.977	13.9
3 08			0.346	0.8	8 08	0.964	13.6	13 08	0.998	14.7
3 10			0.458	4.9	8 13	0.993	14.4	13 16	0.996	15.5
3 12			0.565	7.4	8 18	1.000	15.2			
3 14			0.663	9.2						
3 16			0.752	10.5						
3 18			0.828	11.5						
3 20			0.892	12.4						
3 22			0.942	13.2						
4 00			0.976	13.9						
4 02			0.996	14.5						
4 04			0.999	15.2						

Apparent distance of satellite is $F \frac{a}{\Delta}$

Position angle of satellite is $p_1 + p_2$

UNIVERSAL TIME OF GREATEST NORTHERN ELONGATION

ARIEL

Jan.	d h -2 22.1 1 10.6 3 23.0 6 11.5 9 00.0	Feb.	d h 18 07.8 20 20.3 23 08.8 25 21.3 28 09.7	Apr.	d h 9 17.6 12 06.1 14 18.6 17 07.1 19 19.6	May June	d h 30 03.5 1 16.0 4 04.5 6 17.0 9 05.5	July	d h 19 13.4 22 01.9 24 14.4 27 02.8 29 15.3	Nov.	d h 15 00.2 17 12.7 20 01.2 22 13.7 25 02.1
	11 12.5 14 01.0 16 13.5 19 02.0 21 14.4	Mar.	2 22.2 5 10.7 7 23.2 10 11.7 13 00.2		22 08.1 24 20.6 27 09.1 29 21.6 May 2 10.1		11 18.0 14 06.5 16 19.0 19 07.5 21 20.0	Aug.	1 03.8 3 16.3 6 04.8 8 17.3	Dec.	27 14.6 30 03.1 2 15.6 5 04.1 7 16.6
	24 02.9 26 15.4 29 03.9 31 16.4 Feb. 3 04.9		15 12.7 18 01.2 20 13.7 23 02.2 25 14.7		4 22.6 7 11.1 9 23.6 12 12.0 15 00.5	July	24 08.5 26 20.9 29 09.4 1 21.9 4 10.4	Oct.	20 19.4 23 07.9 25 20.4 28 08.9 30 21.3		10 05.0 12 17.5 15 06.0 17 18.5 20 07.0
	5 17.4 8 05.8 10 18.3 13 06.8 15 19.3	Apr.	28 03.2 30 15.7 2 04.1 4 16.6 7 05.1		17 13.0 20 01.5 22 14.0 25 02.5 27 15.0		6 22.9 9 11.4 11 23.9 14 12.4 17 00.9	Nov.	2 09.8 4 22.3 7 10.8 9 23.3 12 11.7		22 19.5 25 07.9 27 20.4 30 08.9 32 21.4

UMBRIEL

Jan.	d h -3 10.1 1 13.6 5 17.1 9 20.5 14 00.0 18 03.4	Feb.	d h 16 03.6 20 07.1 24 10.5 28 14.0 Mar. 4 17.5 8 20.9	Apr.	d h 6 21.2 11 00.7 15 04.1 19 07.6 23 11.1 27 14.6	May June	d h 26 14.8 30 18.3 3 21.8 8 01.3 12 04.7 16 08.2	July	d h 15 08.4 19 11.9 23 15.4 27 18.8 31 22.3 Aug. 5 01.7	Nov.	d h 16 16.0 20 19.5 24 22.9 29 02.4 Dec. 3 05.8 7 09.2
	22 06.9 26 10.3 30 13.8 Feb. 03 17.2 07 20.7 12 00.2		13 00.4 17 03.9 21 07.3 25 10.8 29 14.3 Apr. 2 17.7	May	1 18.0 5 21.5 10 01.0 14 04.4 18 07.9 22 11.4	July	20 11.6 24 15.1 28 18.6 2 22.0 7 01.5 11 05.0	Oct.	26 22.8 31 02.2 Nov. 4 05.7 8 09.1 12 12.6		11 12.7 15 16.1 19 19.6 23 23.0 28 02.5 32 05.9

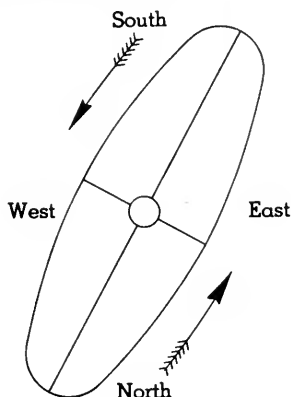
TITANIA

Jan.	d h -8 10.7 1 03.6 9 20.6 18 13.5 27 06.5 Feb. 4 23.4	Feb.	d h 13 16.3 22 09.3 Mar. 3 02.2 11 19.2 20 12.2 29 05.2	Apr.	d h 6 22.2 15 15.1 24 08.1 May 3 01.1 11 18.1 20 11.0	May June	d h 29 04.0 6 20.9 15 13.9 24 06.8 July 2 23.8 11 16.7	July	d h 20 09.6 29 02.5 Aug. 6 19.5 Nov. 1 20.4 10 13.3	Nov.	d h 19 06.2 27 23.1 Dec. 6 16.0 15 08.9 23 25.9 32 18.8
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OBERON

Jan.	d h -5 08.7 8 19.8 22 06.9 Feb. 4 18.0	Feb.	d h 18 05.1 Mar. 3 16.3 17 03.5 30 14.7	Apr.	d h 13 01.9 26 13.1 May 10 00.3 23 11.4	June	d h 5 22.6 19 09.7 July 2 20.8 16 07.9	July	d h 29 18.9 Nov. 1 00.1 14 11.1	Nov.	d h 27 22.1 Dec. 11 09.2 24 20.2 38 07.3
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APPARENT ORBIT OF TRITON AT DATE OF OPPOSITION, MAY 14



NAME
I Triton
II Nereid

SIDEREAL PERIOD
5^d 21^h.044
359^d.88

TRITON

UNIVERSAL TIME OF GREATEST EASTERN ELONGATION

Jan. - 2 09.5 4 06.5 10 03.5 16 00.5 21 21.5	Feb. 20 06.5 26 03.6 Mar. 4 00.6 9 21.6 15 18.7	Apr. 14 04.0 20 01.1 25 22.2 May 1 19.3 7 16.3	June 6 01.8 11 22.9 17 20.0 23 17.1 29 14.2	July 28 23.5 Aug. 3 20.6 9 17.6 15 14.7 21 11.7	Sept. 19 20.9 25 17.9 Oct. 1 14.9 7 11.9 13 09.0
Feb. 27 18.5 2 15.5 8 12.5 14 09.5	21 15.7 27 12.8 Apr. 2 09.9 8 06.9	13 13.4 19 10.5 25 07.6 31 04.7	July 5 11.2 11 08.3 17 05.4 23 02.5	27 08.8 Sept. 2 05.8 8 02.8 13 23.8	Dec. 22 20.7 28 17.6 34 14.6

APPARENT DISTANCE AND POSITION ANGLE

Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2	Date (0 ^h U.T.)	$\frac{a}{\Delta}$	p_2
Jan. -10	15.7	-0.2	Mar. 31	16.5	-0.6	July 9	16.5	+0.7	Oct. 17	15.7	0.0
10	15.9	0.5	Apr. 20	16.7	0.4	29	16.3	0.7	..	..	..
30	16.0	0.7	May 10	16.7	-0.1	Aug. 18	16.1	0.7	..	..	..
Feb. 19	16.2	0.8	30	16.7	+0.2	Sept. 7	16.0	0.6	Dec. 16	15.7	-1.2
Mar. 11	16.4	-0.8	June 19	16.6	+0.5	27	15.8	+0.4	36	15.8	-1.5

Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1	Time from Eastern Elongation	F	p_1
d h		$^{\circ}$	d h		$^{\circ}$	d h		$^{\circ}$	d h		$^{\circ}$
0 00	1.000	149.0	1 12	0.331	244.7	3 00	0.998	330.2	4 12	0.343	75.7
0 03	0.992	151.5	1 15	0.365	266.0	3 03	0.982	332.8	4 15	0.395	94.6
0 06	0.968	154.2	1 18	0.432	282.2	3 06	0.951	335.5	4 18	0.472	108.3
0 09	0.930	157.0	1 21	0.516	293.5	3 09	0.905	338.4	4 21	0.560	117.8
0 12	0.877	160.1	2 00	0.605	301.6	3 12	0.846	341.7	5 00	0.649	124.8
0 15	0.811	163.7	2 03	0.693	307.7	3 15	0.775	345.6	5 03	0.733	130.1
0 18	0.735	167.8	2 06	0.774	312.4	3 18	0.694	350.3	5 06	0.810	134.3
0 21	0.650	173.1	2 09	0.845	316.2	3 21	0.607	356.3	5 09	0.876	137.9
1 00	0.561	180.0	2 12	0.904	319.5	4 00	0.517	4.3	5 12	0.929	141.0
1 03	0.473	189.6	2 15	0.951	322.5	4 03	0.433	15.6	5 15	0.968	143.8
1 06	0.396	203.1	2 18	0.982	325.1	4 06	0.366	31.7	5 18	0.992	146.4
1 09	0.343	222.0	2 21	0.998	327.7	4 09	0.332	52.9	5 21	1.000	148.9

Apparent distance of satellite is $F \frac{a}{\Delta}$ Position angle of satellite is $p_1 + p_2$

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Lat. \ Date		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
SUNRISE (UPPER LIMB)														
Jan.	0	5 59	6 16	6 35	6 56	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
	5	6 02	6 18	6 36	6 57	7 09	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 00
	10	6 04	6 20	6 37	6 57	7 09	7 22	7 37	7 56	8 05	8 15	8 27	8 40	8 55
	15	6 06	6 21	6 38	6 57	7 08	7 20	7 35	7 53	8 02	8 11	8 22	8 34	8 49
	20	6 07	6 22	6 38	6 56	7 06	7 18	7 32	7 49	7 57	8 06	8 16	8 27	8 41
Feb.	25	6 09	6 23	6 37	6 54	7 04	7 15	7 28	7 44	7 51	7 59	8 09	8 19	8 31
	30	6 10	6 23	6 36	6 52	7 01	7 11	7 23	7 38	7 44	7 52	8 00	8 09	8 20
	4	6 10	6 22	6 35	6 49	6 57	7 07	7 17	7 30	7 36	7 43	7 51	7 59	8 09
	9	6 11	6 21	6 33	6 46	6 53	7 01	7 11	7 22	7 28	7 34	7 40	7 48	7 56
	14	6 11	6 20	6 30	6 42	6 48	6 55	7 04	7 14	7 19	7 24	7 29	7 36	7 43
Mar.	19	6 11	6 19	6 27	6 37	6 43	6 49	6 56	7 05	7 09	7 13	7 18	7 23	7 29
	24	6 10	6 17	6 24	6 32	6 37	6 42	6 48	6 55	6 58	7 02	7 06	7 10	7 15
	1	6 09	6 15	6 20	6 27	6 31	6 35	6 39	6 45	6 48	6 50	6 53	6 57	7 01
	6	6 08	6 12	6 17	6 21	6 24	6 27	6 31	6 35	6 37	6 39	6 41	6 43	6 46
	11	6 07	6 10	6 13	6 16	6 17	6 19	6 21	6 24	6 25	6 27	6 28	6 29	6 31
Apr.	16	6 06	6 07	6 08	6 10	6 11	6 11	6 12	6 13	6 14	6 14	6 15	6 16	6 16
	21	6 04	6 04	6 04	6 04	6 03	6 03	6 03	6 02	6 02	6 02	6 02	6 01	6 01
	26	6 03	6 01	6 00	5 58	5 56	5 55	5 53	5 52	5 51	5 50	5 48	5 47	5 46
	31	6 01	5 58	5 55	5 52	5 49	5 47	5 44	5 41	5 39	5 37	5 35	5 33	5 31
	5	6 00	5 55	5 51	5 46	5 42	5 39	5 35	5 30	5 28	5 25	5 22	5 19	5 16

BEGINNING OF ASTRONOMICAL TWILIGHT

Jan.	0	4 44	5 01	5 15	5 30	5 36	5 44	5 51	6 00	6 02	6 06	6 10	6 14	6 18
	5	4 46	5 03	5 18	5 32	5 38	5 45	5 52	6 00	6 03	6 07	6 10	6 14	6 18
	10	4 49	5 05	5 19	5 32	5 39	5 46	5 53	5 59	6 02	6 05	6 09	6 12	6 16
	15	4 51	5 07	5 20	5 33	5 39	5 45	5 51	5 58	6 01	6 03	6 06	6 09	6 12
	20	4 54	5 08	5 21	5 32	5 38	5 44	5 49	5 55	5 57	5 59	6 02	6 05	6 07
Feb.	25	4 55	5 10	5 21	5 32	5 36	5 42	5 46	5 51	5 53	5 55	5 57	5 59	6 01
	30	4 58	5 10	5 21	5 30	5 35	5 39	5 42	5 47	5 48	5 49	5 51	5 52	5 53
	4	4 58	5 10	5 20	5 28	5 32	5 35	5 38	5 41	5 41	5 43	5 44	5 44	5 45
	9	5 00	5 10	5 18	5 25	5 28	5 30	5 32	5 34	5 35	5 35	5 35	5 35	5 35
	14	5 00	5 10	5 17	5 21	5 24	5 25	5 26	5 27	5 26	5 26	5 26	5 25	5 24
Mar.	19	5 01	5 08	5 14	5 18	5 19	5 19	5 20	5 19	5 18	5 16	5 15	5 14	5 12
	24	5 00	5 07	5 11	5 13	5 14	5 13	5 12	5 09	5 07	5 06	5 04	5 02	4 59
	1	5 00	5 05	5 08	5 08	5 08	5 06	5 03	4 59	4 58	4 55	4 52	4 49	4 45
	6	4 59	5 03	5 04	5 04	5 01	4 59	4 54	4 49	4 46	4 43	4 39	4 35	4 29
	11	4 58	5 00	5 00	4 58	4 55	4 51	4 45	4 38	4 34	4 30	4 25	4 20	4 13
Apr.	16	4 57	4 58	4 56	4 51	4 48	4 43	4 36	4 27	4 22	4 17	4 12	4 04	3 56
	21	4 55	4 55	4 52	4 45	4 40	4 34	4 26	4 15	4 09	4 03	3 56	3 48	3 38
	26	4 54	4 52	4 47	4 39	4 33	4 25	4 15	4 03	3 56	3 49	3 40	3 30	3 19
	31	4 52	4 49	4 42	4 32	4 25	4 17	4 05	3 50	3 42	3 34	3 24	3 12	2 58
	5	4 51	4 46	4 38	4 26	4 17	4 07	3 54	3 36	3 28	3 17	3 06	2 52	2 35

SOUTHERN LATITUDES (July to October)

For dates on first line below, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	July	1	7	12	17	23	28	Aug.	2	Aug.	8	13	18	23	29	Sept.	3	8	13	18	23	28	Oct.	4	Oct.	9
Use	Jan.	0	5	10	15	20	25	Jan.	30	Feb.	4	9	14	19	24	Mar.	1	6	11	16	21	26	Mar.	31	Apr.	5
Apply		+1	0	-2	-3	-4	-6		-7		-8	-9	-10	-11	-12		-13	-14	-14	-14	-15	-15		-15		-15

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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SUNSET (UPPER LIMB)

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	18	07	17	49	17	31	17	10	16	58	16	44	16	28	16	07
	5	18	09	17	52	17	34	17	14	17	02	16	48	16	32	16	13
	10	18	11	17	55	17	38	17	18	17	06	16	53	16	38	16	19
	15	18	13	17	57	17	41	17	22	17	11	16	59	16	44	16	26
	20	18	15	18	00	17	44	17	26	17	16	17	04	16	50	16	33
Feb.	25	18	16	18	02	17	47	17	31	17	21	17	10	16	57	16	41
	30	18	17	18	04	17	50	17	35	17	26	17	16	17	04	16	50
	4	18	17	18	06	17	53	17	39	17	31	17	22	17	11	16	58
	9	18	18	18	07	17	56	17	43	17	36	17	28	17	18	17	07
	14	18	18	18	08	17	59	17	47	17	41	17	34	17	26	17	15
Mar.	19	18	17	18	09	18	01	17	51	17	46	17	40	17	33	17	24
	24	18	17	18	10	18	03	17	55	17	51	17	45	17	40	17	33
	1	18	16	18	11	18	05	17	59	17	55	17	51	17	46	17	41
	6	18	15	18	11	18	07	18	02	17	59	17	56	17	53	17	49
	11	18	13	18	11	18	08	18	05	18	04	18	02	18	00	17	57
Apr.	16	18	12	18	11	18	10	18	08	18	08	18	07	18	06	18	05
	21	18	11	18	11	18	11	18	12	18	12	18	12	18	13	18	13
	26	18	09	18	11	18	13	18	15	18	16	18	17	18	19	18	21
	31	18	08	18	11	18	14	18	18	18	20	18	23	18	26	18	29
	5	18	06	18	11	18	15	18	21	18	24	18	28	18	32	18	37

END OF ASTRONOMICAL TWILIGHT

		h	m	h	m	h	m	h	m	h	m	h	m	h	m	h	m
Jan.	0	19	22	19	04	18	50	18	35	18	29	18	21	18	14	18	06
	5	19	24	19	07	18	52	18	39	18	32	18	25	18	18	18	11
	10	19	25	19	10	18	56	18	43	18	36	18	29	18	23	18	16
	15	19	27	19	11	18	58	18	46	18	40	18	35	18	28	18	22
	20	19	28	19	14	19	01	18	49	18	44	18	39	18	33	18	28
Feb.	25	19	29	19	15	19	03	18	54	18	49	18	44	18	39	18	35
	30	19	29	19	17	19	06	18	57	18	53	18	49	18	45	18	42
	4	19	29	19	18	19	08	19	01	18	57	18	55	18	52	18	49
	9	19	29	19	19	19	11	19	04	19	02	19	00	18	58	18	57
	14	19	29	19	19	19	13	19	08	19	06	19	05	19	05	19	04
Mar.	19	19	27	19	20	19	15	19	11	19	11	19	11	19	12	19	13
	24	19	27	19	20	19	17	19	15	19	15	19	15	19	18	19	21
	1	19	25	19	21	19	18	19	19	19	19	19	21	19	24	19	29
	6	19	24	19	21	19	20	19	21	19	23	19	26	19	31	19	37
	11	19	22	19	21	19	21	19	24	19	28	19	32	19	38	19	45
Apr.	16	19	21	19	21	19	23	19	28	19	32	19	37	19	44	19	54
	21	19	20	19	21	19	24	19	32	19	37	19	43	19	52	20	03
	26	19	18	19	21	19	27	19	35	19	41	19	49	19	59	20	13
	31	19	17	19	21	19	28	19	39	19	46	19	56	20	08	20	23
	5	19	15	19	21	19	29	19	42	19	51	20	02	20	15	20	33

SOUTHERN LATITUDES (July to October)

For dates on first line *below*, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	July	1	7	12	17	23	28	Aug.	2	Aug.	8	13	18	23	29	Sept.	3	8	13	18	23	28	Oct.	4	Oct.	9
Use	Jan.	0	5	10	15	20	25	Jan.	30	Feb.	4	9	14	19	24	Mar.	1	6	11	16	21	26	Mar.	31	Apr.	5
Apply		+1	0	-2	-3	-4	-6		-7		-8	-9	-10	-11	-12		-13	-14	-14	-14	-15	-15		-15		-15

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Date														
SUNRISE (UPPER LIMB)														
Apr.	5	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	10	6 00	5 55	5 51	5 46	5 42	5 39	5 35	5 30	5 28	5 25	5 22	5 19	5 16
	15	5 58	5 53	5 47	5 40	5 36	5 31	5 26	5 19	5 16	5 13	5 09	5 05	5 01
	20	5 57	5 50	5 43	5 34	5 29	5 23	5 17	5 09	5 05	5 01	4 56	4 51	4 46
	25	5 56	5 48	5 39	5 29	5 23	5 16	5 08	4 59	4 54	4 49	4 44	4 38	4 31
May	30	5 55	5 45	5 35	5 24	5 17	5 09	5 00	4 49	4 44	4 38	4 32	4 25	4 17
	5	5 54	5 43	5 32	5 19	5 11	5 02	4 52	4 40	4 34	4 27	4 20	4 12	4 03
	10	5 53	5 42	5 29	5 14	5 06	4 56	4 45	4 31	4 24	4 17	4 09	4 00	3 49
	15	5 53	5 40	5 26	5 10	5 01	4 51	4 38	4 23	4 15	4 07	3 58	3 48	3 36
	20	5 53	5 39	5 24	5 07	4 57	4 46	4 32	4 15	4 07	3 58	3 49	3 37	3 24
June	25	5 53	5 38	5 22	5 04	4 53	4 41	4 26	4 08	4 00	3 50	3 40	3 27	3 13
	30	5 53	5 38	5 21	5 02	4 50	4 37	4 22	4 03	3 54	3 43	3 32	3 18	3 02
	4	5 54	5 38	5 20	5 00	4 48	4 34	4 18	3 58	3 48	3 37	3 25	3 11	2 53
	9	5 54	5 38	5 20	4 59	4 47	4 32	4 15	3 54	3 44	3 33	3 20	3 04	2 46
	14	5 55	5 38	5 20	4 58	4 46	4 31	4 13	3 52	3 41	3 29	3 16	3 00	2 40
July	19	5 56	5 39	5 20	4 58	4 45	4 30	4 13	3 50	3 40	3 27	3 13	2 57	2 37
	24	5 57	5 40	5 21	4 59	4 46	4 31	4 13	3 50	3 39	3 27	3 13	2 56	2 35
	29	5 59	5 41	5 22	5 00	4 47	4 32	4 14	3 51	3 40	3 28	3 14	2 57	2 36
	4	6 00	5 42	5 23	5 01	4 48	4 33	4 15	3 53	3 42	3 30	3 16	3 00	2 39
	9	6 01	5 43	5 25	5 03	4 50	4 36	4 18	3 56	3 46	3 34	3 20	3 04	2 44
		6 01	5 45	5 27	5 06	4 53	4 39	4 22	4 00	3 50	3 39	3 26	3 10	2 51

BEGINNING OF ASTRONOMICAL TWILIGHT

Apr.	5	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	10	4 51	4 46	4 38	4 26	4 17	4 07	3 54	3 36	3 28	3 17	3 06	2 52	2 35
	15	4 49	4 42	4 33	4 19	4 09	3 58	3 43	3 22	3 12	3 01	2 47	2 30	2 09
	20	4 47	4 40	4 28	4 12	4 01	3 48	3 32	3 09	2 57	2 43	2 27	2 06	1 38
	25	4 46	4 36	4 24	4 06	3 54	3 40	3 20	2 55	2 41	2 25	2 05	1 39	0 55
May	30	4 44	4 34	4 19	4 00	3 46	3 30	3 09	2 40	2 24	2 05	1 40	1 01	
	5	4 43	4 31	4 15	3 54	3 39	3 21	2 58	2 24	2 07	1 43	1 08		
	10	4 42	4 29	4 12	3 47	3 32	3 12	2 46	2 09	1 47	1 17	0 07		
	15	4 41	4 26	4 08	3 42	3 25	3 05	2 35	1 52	1 26	0 41			
	20	4 40	4 24	4 05	3 38	3 20	2 56	2 25	1 36	1 01				
June	25	4 40	4 23	4 02	3 33	3 14	2 49	2 15	1 18	0 22				
	30	4 39	4 22	3 59	3 29	3 09	2 43	2 06	0 57		When no times are given, twilight lasts all night.			
	4	4 40	4 21	3 58	3 26	3 06	2 37	1 58	0 31					
	9	4 40	4 21	3 57	3 24	3 02	2 33	1 51						
	14	4 40	4 21	3 56	3 22	3 00	2 30	1 45						
July	19	4 41	4 22	3 56	3 22	2 58	2 27	1 41						
	24	4 42	4 22	3 57	3 22	2 59	2 28	1 40						
	29	4 43	4 22	3 57	3 23	2 59	2 28	1 40						
	4	4 44	4 24	3 59	3 25	3 01	2 30	1 43						
	9	4 45	4 26	4 00	3 27	3 04	2 33	1 48						

SOUTHERN LATITUDES (October to January)

For dates on first line below, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Oct.	9	13	18	23	28	Nov.	2	Nov.	7	12	17	21	26	Dec.	1	Dec.	6	10	15	20	24	29	Jan.	2	Jan.	7
Use	Apr.	5	10	15	20	25	Apr.	30	May	5	10	15	20	25	May	30	June	4	9	14	19	24	29	July	4	July	9
Apply		-15	-15	-15	-15	-14		-14		-13	-12	-11	-11	-10		-9		-7	-7	-5	-4	-3	-2		-1		+1

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.															
		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°	
SUNSET (UPPER LIMB)															
Apr.	5	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	10	18 06	18 11	18 15	18 21	18 24	18 28	18 33	18 38	18 45	18 48	18 51	18 55	18 59	19 04
	15	18 04	18 10	18 18	18 27	18 32	18 38	18 44	18 53	18 56	19 01	19 05	19 10	19 16	19 20
	20	18 02	18 11	18 20	18 30	18 36	18 43	18 51	19 01	19 05	19 10	19 16	19 22	19 29	19 35
	25	18 01	18 11	18 21	18 33	18 40	18 48	18 57	19 08	19 13	19 19	19 26	19 33	19 41	19 48
May	30	18 01	18 11	18 23	18 36	18 44	18 53	19 03	19 16	19 22	19 29	19 36	19 44	19 54	20 06
	5	18 00	18 12	18 25	18 39	18 48	18 58	19 10	19 24	19 30	19 38	19 46	19 55	20 06	20 18
	10	18 00	18 13	18 27	18 43	18 52	19 03	19 16	19 31	19 38	19 47	19 56	20 06	20 18	20 30
	15	18 00	18 14	18 29	18 46	18 56	19 08	19 21	19 38	19 46	19 55	20 05	20 17	20 30	20 42
	20	18 00	18 15	18 31	18 49	19 00	19 12	19 27	19 45	19 54	20 03	20 14	20 27	20 42	20 57
June	25	18 00	18 16	18 33	18 52	19 04	19 17	19 32	19 52	20 01	20 11	20 23	20 37	20 53	21 09
	30	18 01	18 17	18 35	18 55	19 07	19 21	19 37	19 57	20 07	20 18	20 31	20 45	21 03	21 18
	4	18 02	18 19	18 37	18 58	19 10	19 24	19 41	20 03	20 13	20 24	20 37	20 53	21 11	21 27
	9	18 03	18 20	18 38	19 00	19 13	19 27	19 45	20 07	20 17	20 29	20 43	20 59	21 19	21 36
	14	18 04	18 21	18 40	19 02	19 15	19 30	19 48	20 10	20 21	20 33	20 47	21 04	21 24	21 43
July	19	18 05	18 22	18 41	19 03	19 16	19 32	19 50	20 12	20 23	20 35	20 50	21 06	21 27	21 48
	24	18 06	18 23	18 42	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 51	21 07	21 28	21 50
	29	18 07	18 24	18 43	19 05	19 18	19 33	19 51	20 13	20 24	20 36	20 50	21 07	21 27	21 49
	4	18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23	21 46
	9	18 09	18 25	18 43	19 04	19 17	19 31	19 48	20 09	20 19	20 31	20 44	20 59	21 17	21 41

END OF ASTRONOMICAL TWILIGHT

Apr.	5	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	10	19 15	19 21	19 29	19 42	19 51	20 02	20 15	20 33	20 42	20 53	21 05	21 19	21 38
	15	19 14	19 22	19 32	19 46	19 56	20 08	20 23	20 44	20 55	21 06	21 21	21 38	22 01
	20	19 14	19 21	19 33	19 50	20 01	20 15	20 31	20 56	21 07	21 22	21 39	22 00	22 31
	25	19 12	19 23	19 36	19 54	20 06	20 22	20 41	21 08	21 22	21 38	22 00	22 28	23 19
May	30	19 12	19 23	19 38	19 58	20 12	20 29	20 50	21 20	21 36	21 56	22 23	23 07	
	5	19 12	19 24	19 41	20 03	20 18	20 36	21 00	21 34	21 53	22 18	22 55		
	10	19 12	19 26	19 44	20 07	20 23	20 43	21 10	21 49	22 11	22 44			
	15	19 12	19 27	19 46	20 12	20 29	20 51	21 20	22 04	22 32	23 23			
	20	19 13	19 29	19 49	20 17	20 35	20 59	21 30	22 21	22 58				
June	25	19 13	19 30	19 52	20 21	20 40	21 05	21 40	22 40	23 53				
	30	19 14	19 32	19 55	20 25	20 46	21 13	21 50	23 02					
	5	19 15	19 34	19 58	20 29	20 51	21 19	21 59	23 32					
	10	19 17	19 36	20 00	20 33	20 55	21 24	22 07						
	15	19 18	19 37	20 02	20 36	20 59	21 29	22 15						
July	20	19 19	19 39	20 04	20 38	21 02	21 33	22 20						
	25	19 20	19 40	20 05	20 40	21 03	21 35	22 23						
	30	19 21	19 41	20 06	20 42	21 05	21 36	22 24						
	5	19 22	19 42	20 07	20 41	21 05	21 36	22 23						
	10	19 23	19 42	20 08	20 41	21 04	21 33	22 19						

When no times are given,
twilight lasts all night.

SOUTHERN LATITUDES (October to January)

For dates on first line below, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	Oct. 9	13	18	23	28	Nov. 2	Nov. 7	12	17	21	26	Dec. 1	Dec. 6	10	15	20	24	29	Jan. 2	Jan. 7
Use	Apr. 5	10	15	20	25	Apr. 30	May 5	10	15	20	25	May 30	June 4	9	14	19	24	29	July 4	July 9
Apply	-15	-15	-15	-15	-14	-14	-13	-12	-11	-11	-10	-9	-7	-7	-5	-4	-3	-2	-1	+1

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SUNRISE AND TWILIGHT, 1967

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
SUNRISE (UPPER LIMB)														
July	4	h m 6 01	h m 5 43	h m 5 25	h m 5 03	h m 4 50	h m 4 36	h m 4 18	h m 3 56	h m 3 46	h m 3 34	h m 3 20	h m 3 04	h m 2 44
	9	6 01	5 45	5 27	5 06	4 53	4 39	4 22	4 00	3 50	3 39	3 26	3 10	2 51
	14	6 02	5 46	5 28	5 08	4 56	4 42	4 26	4 05	3 56	3 45	3 32	3 18	3 00
	19	6 03	5 47	5 30	5 11	4 59	4 46	4 30	4 11	4 02	3 51	3 40	3 26	3 10
	24	6 03	5 48	5 32	5 14	5 03	4 50	4 36	4 17	4 09	3 59	3 48	3 35	3 20
Aug.	29	6 03	5 49	5 34	5 17	5 06	4 55	4 41	4 24	4 16	4 07	3 57	3 45	3 32
	3	6 03	5 50	5 36	5 20	5 10	4 59	4 46	4 31	4 23	4 15	4 06	3 55	3 43
	8	6 02	5 50	5 37	5 23	5 14	5 04	4 52	4 38	4 31	4 24	4 16	4 06	3 55
	13	6 02	5 51	5 39	5 26	5 18	5 09	4 58	4 45	4 39	4 33	4 25	4 17	4 07
	18	6 01	5 51	5 41	5 29	5 22	5 14	5 04	4 53	4 48	4 42	4 35	4 28	4 19
Sept.	23	5 59	5 51	5 42	5 31	5 25	5 18	5 10	5 00	4 56	4 51	4 45	4 39	4 31
	28	5 58	5 51	5 43	5 34	5 29	5 23	5 16	5 08	5 04	5 00	4 55	4 49	4 43
	2	5 57	5 51	5 44	5 37	5 33	5 28	5 22	5 15	5 12	5 09	5 05	5 00	4 55
	7	5 55	5 50	5 45	5 40	5 36	5 33	5 28	5 23	5 20	5 17	5 14	5 11	5 07
	12	5 53	5 50	5 47	5 42	5 40	5 37	5 34	5 30	5 28	5 26	5 24	5 22	5 19
Oct.	17	5 52	5 50	5 48	5 45	5 44	5 42	5 40	5 38	5 36	5 35	5 34	5 32	5 31
	22	5 50	5 49	5 49	5 48	5 47	5 47	5 46	5 45	5 45	5 44	5 44	5 43	5 42
	27	5 48	5 49	5 50	5 51	5 51	5 52	5 52	5 53	5 53	5 53	5 53	5 54	5 54
	2	5 46	5 49	5 51	5 53	5 55	5 56	5 58	6 00	6 01	6 02	6 03	6 05	6 06
	7	5 45	5 48	5 52	5 56	5 59	6 01	6 04	6 08	6 10	6 11	6 13	6 16	6 18

BEGINNING OF ASTRONOMICAL TWILIGHT

July	4	h m 4 45	h m 4 26	h m 4 00	h m 3 27	h m 3 04	h m 2 33	h m 1 48	h m h m	h m h m	h m h m	h m h m	h m h m	h m h m
	9	4 46	4 27	4 03	3 30	3 08	2 38	1 55						
	14	4 48	4 29	4 05	3 33	3 11	2 44	2 03	0 27	When no times are given, twilight lasts all night.				
	19	4 48	4 31	4 08	3 37	3 17	2 49	2 11	0 59					
	24	4 50	4 32	4 11	3 41	3 21	2 56	2 21	1 20					
Aug.	29	4 50	4 34	4 14	3 45	3 27	3 03	2 31	1 39	1 00				
	3	4 51	4 36	4 15	3 50	3 32	3 10	2 40	1 55	1 27	0 33			
	8	4 50	4 36	4 18	3 54	3 38	3 17	2 50	2 11	1 48	1 14			
	13	4 51	4 38	4 21	3 58	3 43	3 25	3 00	2 25	2 06	1 41	1 01		
	18	4 50	4 39	4 23	4 02	3 49	3 32	3 09	2 38	2 22	2 02	1 34	0 47	
Sept.	23	4 50	4 39	4 26	4 07	3 54	3 38	3 18	2 51	2 37	2 20	1 58	1 28	0 29
	28	4 48	4 40	4 28	4 11	3 59	3 45	3 27	3 03	2 50	2 36	2 18	1 55	1 23
	2	4 48	4 40	4 29	4 14	4 04	3 52	3 35	3 14	3 03	2 51	2 36	2 17	1 54
	7	4 46	4 41	4 31	4 17	4 09	3 58	3 44	3 24	3 16	3 05	2 51	2 37	2 18
	12	4 45	4 40	4 32	4 21	4 13	4 03	3 51	3 35	3 27	3 17	3 06	2 53	2 38
Oct.	17	4 43	4 40	4 33	4 25	4 18	4 09	3 59	3 44	3 37	3 29	3 20	3 09	2 56
	22	4 41	4 39	4 35	4 27	4 22	4 15	4 06	3 54	3 47	3 40	3 33	3 24	3 13
	27	4 39	4 39	4 37	4 30	4 26	4 21	4 13	4 02	3 57	3 51	3 45	3 38	3 28
	2	4 38	4 39	4 38	4 34	4 30	4 25	4 19	4 11	4 07	4 01	3 56	3 49	3 43
	7	4 36	4 38	4 39	4 37	4 34	4 30	4 26	4 19	4 16	4 12	4 07	4 02	3 56

SOUTHERN LATITUDES (January to April)

For dates on first line below, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Jan.	2	7	12	16	21	26	Jan.	31	Feb.	4	9	14	19	23	Feb.	28	Mar.	5	10	15	20	25	Mar.	29	Apr.	3
Use	July	4	9	14	19	24	29	Aug.	3	Aug.	8	13	18	23	28	Sept.	2	Sept.	7	12	17	22	27	Oct.	2	Oct.	7
Apply		-1	+1	+2	+3	+5	+6		+7		+8	+9	+10	+11	+12		+13		+13	+14	+14	+15	+15		+15		+16

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
Date													

SUNSET (UPPER LIMB)

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	4	18 08	18 25	18 44	19 05	19 18	19 32	19 50	20 12	20 22	20 34	20 48	21 04	21 23
	9	18 09	18 25	18 43	19 04	19 17	19 31	19 48	20 09	20 19	20 31	20 44	20 59	21 17
	14	18 09	18 26	18 43	19 03	19 15	19 29	19 45	20 05	20 15	20 26	20 38	20 53	21 10
	19	18 10	18 25	18 42	19 01	19 13	19 26	19 41	20 01	20 10	20 20	20 32	20 45	21 01
	24	18 10	18 25	18 41	18 59	19 10	19 22	19 37	19 55	20 03	20 13	20 24	20 36	20 51
Aug.	29	18 10	18 24	18 39	18 56	19 06	19 18	19 31	19 48	19 56	20 05	20 15	20 26	20 39
	3	18 10	18 23	18 36	18 52	19 02	19 12	19 25	19 41	19 48	19 56	20 05	20 15	20 27
	8	18 09	18 21	18 34	18 48	18 57	19 07	19 18	19 32	19 39	19 46	19 54	20 04	20 14
	13	18 08	18 19	18 31	18 44	18 52	19 00	19 11	19 23	19 29	19 36	19 43	19 51	20 01
	18	18 07	18 17	18 27	18 39	18 46	18 54	19 03	19 14	19 19	19 25	19 31	19 39	19 47
Sept.	23	18 06	18 14	18 23	18 34	18 40	18 46	18 55	19 04	19 09	19 14	19 19	19 25	19 32
	28	18 05	18 12	18 19	18 28	18 33	18 39	18 46	18 54	18 58	19 02	19 07	19 12	19 18
	2	18 03	18 09	18 15	18 22	18 26	18 31	18 37	18 44	18 47	18 50	18 54	18 58	19 03
	7	18 02	18 06	18 11	18 16	18 20	18 23	18 28	18 33	18 35	18 38	18 41	18 44	18 48
	12	18 00	18 03	18 06	18 10	18 12	18 15	18 18	18 22	18 24	18 26	18 28	18 30	18 33
Oct.	17	17 58	18 00	18 02	18 04	18 05	18 07	18 09	18 11	18 12	18 13	18 14	18 16	18 17
	22	17 56	17 57	17 57	17 58	17 58	17 59	17 59	18 00	18 00	18 01	18 01	18 02	18 02
	27	17 54	17 53	17 52	17 51	17 51	17 50	17 50	17 49	17 49	17 48	17 48	17 47	17 47
	2	17 53	17 50	17 48	17 45	17 44	17 42	17 40	17 38	17 37	17 36	17 35	17 33	17 32
	7	17 51	17 48	17 44	17 39	17 37	17 34	17 31	17 27	17 26	17 24	17 22	17 19	17 17

END OF ASTRONOMICAL TWILIGHT

		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	4	19 23	19 42	20 08	20 41	21 04	21 33	22 19						
	9	19 24	19 42	20 06	20 39	21 02	21 31	22 14						
	14	19 23	19 43	20 06	20 37	20 58	21 27	22 06	23 35					
	19	19 24	19 41	20 04	20 34	20 55	21 21	21 58	23 09					
	24	19 23	19 41	20 02	20 31	20 50	21 15	21 50	22 48	23 45				
Aug.	29	19 23	19 39	19 59	20 26	20 44	21 08	21 39	22 30	23 05				
	3	19 22	19 37	19 55	20 21	20 39	21 00	21 29	22 13	22 40	23 27			
	8	19 21	19 35	19 53	20 16	20 32	20 52	21 18	21 56	22 19	22 50			
	13	19 19	19 32	19 49	20 10	20 25	20 43	21 07	21 40	21 59	22 24	22 59		
	18	19 18	19 29	19 44	20 04	20 18	20 35	20 56	21 26	21 41	22 01	22 27	23 09	
Sept.	23	19 16	19 26	19 39	19 58	20 10	20 25	20 45	21 11	21 25	21 41	22 02	22 29	23 18
	28	19 15	19 23	19 34	19 51	20 02	20 16	20 33	20 57	21 09	21 23	21 40	22 01	22 31
	2	19 12	19 20	19 30	19 44	19 54	20 06	20 22	20 43	20 53	21 05	21 19	21 37	22 00
	7	19 11	19 16	19 25	19 37	19 47	19 57	20 11	20 29	20 38	20 48	21 01	21 15	21 33
	12	19 09	19 13	19 20	19 31	19 38	19 48	19 59	20 15	20 24	20 33	20 43	20 55	21 10
Oct.	17	19 07	19 10	19 15	19 24	19 30	19 39	19 49	20 02	20 09	20 17	20 25	20 36	20 48
	22	19 05	19 07	19 10	19 18	19 23	19 30	19 38	19 50	19 55	20 02	20 09	20 19	20 28
	27	19 03	19 03	19 05	19 11	19 15	19 20	19 28	19 38	19 43	19 48	19 54	20 01	20 10
	2	19 02	19 00	19 01	19 04	19 08	19 12	19 18	19 26	19 30	19 35	19 40	19 45	19 53
	7	19 00	18 58	18 57	18 58	19 01	19 04	19 08	19 14	19 18	19 22	19 26	19 30	19 36

SOUTHERN LATITUDES (January to April)

For dates on first line below, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	Jan.	2	7	12	16	21	26	Jan.	31	Feb.	4	9	14	19	23	Feb.	28	Mar.	5	10	15	20	25	Mar.	29	Apr.	3
Use	July	4	9	14	19	24	29	Aug.	3	Aug.	8	13	18	23	28	Sept.	2	Sept.	7	12	17	22	27	Oct.	2	Oct.	7
Apply		-1	+1	+2	+3	+5	+6		+7		+8	+9	+10	+11	+12		+13		+13	+14	+14	+15	+15		+15		+15

LOCAL MEAN TIME OF SUNRISE AND BEGINNING OF ASTRONOMICAL TWILIGHT—MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
SUNRISE (UPPER LIMB)														
Oct.	2	5 46	5 49	5 51	5 53	5 55	5 56	5 58	6 00	6 01	6 02	6 03	6 05	6 06
	7	5 45	5 48	5 52	5 56	5 59	6 01	6 04	6 08	6 10	6 11	6 13	6 16	6 18
	12	5 43	5 48	5 54	5 59	6 03	6 06	6 11	6 16	6 18	6 21	6 23	6 27	6 30
	17	5 42	5 49	5 55	6 03	6 07	6 12	6 17	6 24	6 27	6 30	6 34	6 38	6 42
	22	5 41	5 49	5 57	6 06	6 11	6 17	6 24	6 32	6 36	6 40	6 44	6 49	6 55
Nov.	27	5 41	5 49	5 59	6 10	6 16	6 23	6 31	6 40	6 45	6 49	6 55	7 01	7 07
	1	5 40	5 50	6 01	6 13	6 20	6 28	6 37	6 48	6 54	6 59	7 05	7 12	7 20
	6	5 40	5 52	6 04	6 17	6 25	6 34	6 44	6 57	7 03	7 09	7 16	7 24	7 33
	11	5 40	5 53	6 06	6 21	6 30	6 40	6 51	7 05	7 12	7 19	7 27	7 36	7 46
	16	5 41	5 55	6 09	6 25	6 35	6 45	6 58	7 13	7 20	7 28	7 37	7 47	7 59
Dec.	21	5 42	5 57	6 12	6 29	6 40	6 51	7 05	7 21	7 29	7 38	7 47	7 58	8 11
	26	5 43	5 59	6 15	6 34	6 44	6 57	7 11	7 29	7 37	7 46	7 57	8 09	8 23
	1	5 45	6 01	6 18	6 38	6 49	7 02	7 17	7 36	7 45	7 55	8 06	8 19	8 34
	6	5 47	6 04	6 21	6 42	6 53	7 07	7 23	7 42	7 51	8 02	8 14	8 27	8 43
	11	5 49	6 06	6 24	6 45	6 57	7 11	7 27	7 48	7 57	8 08	8 20	8 35	8 51
	16	5 52	6 09	6 27	6 49	7 01	7 15	7 32	7 52	8 02	8 13	8 26	8 40	8 58
	21	5 54	6 11	6 30	6 51	7 04	7 18	7 35	7 55	8 05	8 17	8 29	8 44	9 02
	26	5 57	6 14	6 32	6 54	7 06	7 20	7 37	7 58	8 08	8 19	8 31	8 46	9 04
	31	5 59	6 16	6 35	6 55	7 08	7 22	7 38	7 59	8 08	8 19	8 32	8 46	9 03
	36	6 01	6 18	6 36	6 57	7 09	7 22	7 38	7 58	8 08	8 18	8 30	8 44	9 01

BEGINNING OF ASTRONOMICAL TWILIGHT

Oct.	2	4 38	4 39	4 38	4 34	4 30	4 25	4 19	4 11	4 07	4 01	3 56	3 49	3 43
	7	4 36	4 38	4 39	4 37	4 34	4 30	4 26	4 19	4 16	4 12	4 07	4 02	3 56
	12	4 35	4 38	4 40	4 40	4 38	4 35	4 32	4 27	4 24	4 21	4 17	4 13	4 09
	17	4 32	4 39	4 41	4 42	4 42	4 41	4 38	4 35	4 33	4 30	4 28	4 25	4 21
	22	4 31	4 38	4 43	4 45	4 46	4 46	4 44	4 42	4 41	4 40	4 38	4 36	4 33
Nov.	27	4 31	4 38	4 45	4 49	4 50	4 50	4 51	4 50	4 50	4 48	4 48	4 46	4 45
	1	4 29	4 39	4 46	4 52	4 54	4 56	4 57	4 58	4 58	4 57	4 57	4 56	4 56
	6	4 29	4 39	4 48	4 55	4 58	5 01	5 03	5 05	5 06	5 06	5 06	5 07	5 07
	11	4 28	4 40	4 50	4 58	5 02	5 05	5 09	5 12	5 13	5 14	5 16	5 16	5 16
	16	4 28	4 41	4 52	5 01	5 07	5 10	5 15	5 19	5 21	5 22	5 24	5 25	5 27
Dec.	21	4 29	4 42	4 54	5 06	5 11	5 16	5 20	5 26	5 27	5 30	5 31	5 34	5 37
	26	4 29	4 44	4 57	5 09	5 14	5 21	5 26	5 32	5 34	5 37	5 39	5 42	5 44
	1	4 31	4 47	5 00	5 13	5 19	5 25	5 31	5 37	5 40	5 43	5 46	5 50	5 53
	6	4 33	4 48	5 03	5 16	5 22	5 29	5 36	5 43	5 46	5 49	5 53	5 57	6 00
	11	4 34	4 51	5 06	5 20	5 27	5 33	5 41	5 48	5 51	5 55	5 58	6 02	6 06
	16	4 36	4 53	5 08	5 23	5 29	5 37	5 44	5 52	5 55	5 59	6 03	6 07	6 11
	21	4 39	4 56	5 11	5 25	5 32	5 39	5 47	5 55	5 59	6 02	6 07	6 10	6 15
	26	4 41	4 59	5 13	5 27	5 35	5 42	5 50	5 57	6 01	6 04	6 09	6 13	6 17
	31	4 44	5 01	5 15	5 30	5 36	5 43	5 51	6 00	6 02	6 06	6 10	6 14	6 18
	36	4 46	5 03	5 18	5 31	5 38	5 45	5 52	6 00	6 03	6 07	6 10	6 14	6 18

SOUTHERN LATITUDES (April to July)

For dates on first line below, enter tables above with dates on second line, and apply the correction (in minutes) given on the third line.

Date	Apr. 3	9	14	19	24	Apr. 29	May 4	9	14	20	25	May 30	June 4	10	15	21	26	July 1	7
Use	Oct. 7	12	17	22	27	Nov. 1	Nov. 6	11	16	21	26	Dec. 1	Dec. 6	11	16	21	26	Dec. 31	36
Apply	+15	+15	+15	+15	+14	+14	+13	+13	+12	+11	+10	+9	+7	+6	+5	+4	+2	+1	0

LOCAL MEAN TIME OF SUNSET AND END OF ASTRONOMICAL
TWILIGHT—MERIDIAN OF GREENWICH

Date		Lat.													
		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°	
SUNSET (UPPER LIMB)															
Oct.	2	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	
	7	17 53	17 50	17 48	17 45	17 44	17 39	17 37	17 34	17 31	17 27	17 26	17 24	17 22	
	12	17 51	17 48	17 44	17 39	17 37	17 34	17 31	17 27	17 26	17 24	17 22	17 19	17 17	
	17	17 50	17 45	17 39	17 33	17 30	17 26	17 22	17 17	17 14	17 12	17 09	17 06	17 02	
	22	17 49	17 42	17 36	17 28	17 24	17 19	17 13	17 06	17 03	17 00	16 56	16 52	16 48	
Nov.	27	17 48	17 40	17 32	17 23	17 18	17 12	17 05	16 57	16 53	16 49	16 44	16 39	16 33	
	1	17 47	17 38	17 29	17 18	17 12	17 05	16 57	16 47	16 43	16 38	16 32	16 26	16 19	
	6	17 47	17 37	17 26	17 14	17 07	16 59	16 49	16 38	16 33	16 27	16 21	16 14	16 06	
	11	17 47	17 36	17 24	17 10	17 02	16 53	16 43	16 30	16 24	16 18	16 10	16 02	15 53	
	16	17 48	17 35	17 22	17 07	16 58	16 48	16 36	16 22	16 16	16 09	16 01	15 52	15 41	
Dec.	21	17 48	17 35	17 20	17 04	16 54	16 44	16 31	16 16	16 08	16 00	15 52	15 42	15 30	
	26	17 49	17 35	17 19	17 02	16 52	16 40	16 26	16 10	16 02	15 53	15 44	15 33	15 20	
	1	17 51	17 35	17 19	17 01	16 50	16 37	16 23	16 05	15 57	15 48	15 37	15 25	15 11	
	6	17 53	17 36	17 19	17 00	16 49	16 36	16 20	16 02	15 53	15 43	15 32	15 19	15 04	
	11	17 55	17 38	17 20	17 00	16 48	16 35	16 19	15 59	15 50	15 40	15 28	15 14	14 58	
	16	17 57	17 40	17 22	17 01	16 49	16 35	16 18	15 58	15 49	15 38	15 26	15 11	14 54	
	21	17 59	17 42	17 23	17 02	16 50	16 36	16 19	15 58	15 49	15 38	15 25	15 10	14 53	
	26	18 01	17 44	17 25	17 04	16 52	16 38	16 21	16 00	15 50	15 39	15 26	15 11	14 54	
	31	18 04	17 47	17 28	17 07	16 55	16 40	16 24	16 03	15 53	15 42	15 29	15 15	14 57	
	36	18 07	17 49	17 31	17 10	16 58	16 44	16 27	16 07	15 57	15 46	15 34	15 20	15 03	
	36	18 09	17 52	17 34	17 14	17 02	16 48	16 32	16 12	16 03	15 52	15 40	15 26	15 10	

END OF ASTRONOMICAL TWILIGHT

Oct.	2	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	7	19 02	19 00	19 01	19 04	19 08	19 12	19 18	19 26	19 30	19 35	19 40	19 45	19 53	19 53
	12	19 00	18 58	18 57	18 58	19 01	19 04	19 08	19 14	19 18	19 22	19 26	19 30	19 36	19 36
	17	18 59	18 55	18 52	18 52	18 54	18 56	18 59	19 04	19 06	19 10	19 13	19 17	19 21	19 21
	22	18 59	18 52	18 50	18 48	18 48	18 49	18 51	18 53	18 55	18 58	19 00	19 03	19 07	19 07
Nov.	27	18 58	18 51	18 46	18 43	18 42	18 42	18 43	18 45	18 46	18 47	18 48	18 50	18 52	18 52
	1	18 57	18 49	18 43	18 38	18 37	18 36	18 36	18 36	18 36	18 37	18 37	18 38	18 40	18 40
	6	18 58	18 49	18 41	18 35	18 33	18 31	18 28	18 27	18 27	18 27	18 28	18 28	18 28	18 28
	11	18 58	18 48	18 39	18 31	18 28	18 25	18 23	18 20	18 20	18 19	18 18	18 18	18 17	18 17
	16	19 00	18 48	18 38	18 29	18 25	18 21	18 17	18 14	18 13	18 12	18 11	18 10	18 08	18 08
Dec.	21	19 01	18 48	18 36	18 27	18 21	18 18	18 13	18 09	18 06	18 05	18 04	18 02	18 00	18 00
	26	19 02	18 49	18 36	18 25	18 20	18 15	18 09	18 04	18 02	17 59	17 58	17 56	17 53	17 53
	1	19 05	18 49	18 36	18 25	18 19	18 12	18 07	18 01	17 58	17 56	17 53	17 50	17 47	17 47
	6	19 07	18 51	18 37	18 24	18 18	18 12	18 05	17 59	17 56	17 53	17 50	17 47	17 43	17 43
	11	19 10	18 53	18 38	18 25	18 18	18 12	18 05	17 57	17 54	17 51	17 48	17 44	17 40	17 40
	16	19 12	18 55	18 40	18 26	18 19	18 12	18 04	17 57	17 54	17 50	17 47	17 42	17 38	17 38
	21	19 14	18 57	18 42	18 27	18 21	18 14	18 06	17 57	17 55	17 51	17 47	17 43	17 39	17 39
	26	19 16	18 59	18 44	18 30	18 23	18 16	18 08	18 00	17 56	17 53	17 48	17 44	17 40	17 40
	31	19 19	19 02	18 47	18 32	18 26	18 18	18 11	18 02	17 59	17 55	17 51	17 48	17 43	17 43
	36	19 22	19 04	18 50	18 35	18 29	18 21	18 13	18 06	18 02	17 59	17 56	17 52	17 48	17 48
	36	19 24	19 07	18 52	18 39	18 32	18 25	18 18	18 10	18 08	18 04	18 00	17 56	17 53	17 53

SOUTHERN LATITUDES (April to July)

For dates on first line *below*, enter tables above with dates on second line,
and apply the correction (in minutes) given on the third line.

Date	Apr. 3	9	14	19	24	Apr. 29	May 4	9	14	20	25	May 30	June 4	10	15	21	26	July 1	7
Use	Oct. 7	12	17	22	27	Nov. 1	Nov. 6	11	16	21	26	Dec. 1	Dec. 6	11	16	21	26	Dec. 31	36
Apply	+15	+15	+15	+15	+14	+14	+13	+13	+12	+11	+10	+9	+7	+6	+5	+4	+2	+1	0

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	21 53	21 42	21 31	21 18	21 10	21 01	20 51	20 38	20 32	20 26	20 19	20 10	20 01
	1	22 44	22 38	22 31	22 24	22 20	22 15	22 09	22 02	21 59	21 56	21 52	21 48	21 43
	2	23 32	23 31	23 30	23 29	23 28	23 27	23 26	23 25	23 24	23 24	23 23	23 22	23 21
	3	...	...	...	...	...	...	...	...	...	...	...	...	...
	4	0 20	0 24	0 28	0 33	0 35	0 38	0 42	0 46	0 48	0 51	0 53	0 56	0 59
	5	1 09	1 17	1 27	1 37	1 43	1 50	1 58	2 08	2 13	2 18	2 24	2 30	2 37
	6	1 59	2 12	2 26	2 43	2 52	3 03	3 15	3 31	3 38	3 47	3 56	4 07	4 19
	7	2 52	3 09	3 28	3 49	4 01	4 15	4 32	4 54	5 04	5 15	5 29	5 44	6 03
	8	3 48	4 08	4 30	4 54	5 09	5 26	5 47	6 13	6 25	6 40	6 57	7 17	7 44
	9	4 46	5 07	5 31	5 57	6 13	6 31	6 54	7 23	7 37	7 53	8 12	8 36	9 08
	10	5 43	6 05	6 28	6 55	7 10	7 29	7 51	8 19	8 33	8 49	9 08	9 31	10 01
	11	6 39	6 59	7 20	7 45	7 59	8 16	8 36	9 02	9 14	9 27	9 44	10 03	10 26
	12	7 31	7 48	8 07	8 28	8 40	8 55	9 11	9 32	9 42	9 53	10 06	10 20	10 37
	13	8 19	8 33	8 48	9 05	9 15	9 26	9 39	9 55	10 03	10 11	10 20	10 31	10 43
	14	9 03	9 13	9 24	9 37	9 44	9 52	10 02	10 13	10 18	10 24	10 30	10 37	10 45
	15	9 45	9 51	9 58	10 06	10 10	10 15	10 20	10 27	10 30	10 34	10 38	10 42	10 47
	16	10 24	10 27	10 29	10 32	10 34	10 36	10 38	10 40	10 41	10 43	10 44	10 46	10 47
	17	11 04	11 02	11 00	10 58	10 57	10 56	10 54	10 53	10 52	10 51	10 50	10 49	10 48
	18	11 43	11 38	11 31	11 25	11 21	11 16	11 11	11 05	11 03	11 00	10 56	10 53	10 48
	19	12 25	12 15	12 05	11 53	11 46	11 39	11 30	11 20	11 15	11 09	11 04	10 57	10 50
	20	13 09	12 55	12 41	12 24	12 15	12 04	11 52	11 37	11 30	11 22	11 13	11 03	10 52
	21	13 57	13 40	13 21	13 01	12 49	12 35	12 19	11 59	11 50	11 39	11 27	11 13	10 58
	22	14 49	14 29	14 08	13 44	13 30	13 13	12 54	12 29	12 17	12 04	11 49	11 30	11 08
	23	15 46	15 25	15 02	14 34	14 19	14 01	13 39	13 11	12 58	12 42	12 24	12 02	11 32
	24	16 46	16 25	16 01	15 34	15 19	15 00	14 38	14 09	13 55	13 39	13 20	12 56	12 25
	25	17 47	17 27	17 06	16 41	16 26	16 09	15 49	15 23	15 10	14 56	14 39	14 18	13 53
	26	18 47	18 30	18 12	17 51	17 39	17 25	17 08	16 47	16 37	16 26	16 13	15 58	15 40
	27	19 44	19 31	19 17	19 02	18 53	18 43	18 30	18 16	18 09	18 01	17 52	17 42	17 31
	28	20 37	20 29	20 21	20 11	20 06	20 00	19 53	19 44	19 40	19 35	19 30	19 24	19 18
	29	21 28	21 25	21 22	21 19	21 17	21 15	21 12	21 10	21 08	21 07	21 05	21 03	21 01
Feb.	30	22 17	22 19	22 22	22 25	22 27	22 29	22 31	22 34	22 35	22 36	22 38	22 40	22 42
	31	23 06	23 13	23 21	23 31	23 35	23 41	23 49	23 57	...	...	...	...	...
	1	23 56	...	...	...	...	...	...	...	0 01	0 05	0 10	0 15	0 22
	2	...	0 08	0 21	0 36	0 44	0 54	1 06	1 20	1 27	1 34	1 43	1 52	2 03
	3	0 48	1 05	1 22	1 42	1 53	2 07	2 23	2 43	2 52	3 03	3 15	3 29	3 46
	4	1 43	2 02	2 23	2 47	3 01	3 18	3 37	4 02	4 14	4 28	4 45	5 04	5 28
	5	2 39	3 00	3 24	3 50	4 06	4 24	4 46	5 14	5 28	5 44	6 04	6 27	6 59
	6	3 36	3 58	4 21	4 48	5 04	5 23	5 45	6 14	6 28	6 45	7 04	7 29	8 01
	7	4 31	4 52	5 14	5 40	5 55	6 12	6 34	7 00	7 13	7 28	7 45	8 06	8 32
	8	5 24	5 42	6 02	6 25	6 38	6 53	7 11	7 34	7 45	7 57	8 11	8 27	8 46
	9	6 13	6 28	6 45	7 03	7 14	7 26	7 41	7 59	8 07	8 16	8 27	8 39	8 53
	10	6 58	7 10	7 23	7 37	7 45	7 54	8 05	8 18	8 24	8 31	8 38	8 46	8 56
	11	7 41	7 49	7 57	8 06	8 12	8 18	8 25	8 33	8 37	8 41	8 46	8 51	8 57
	12	8 21	8 25	8 29	8 34	8 36	8 39	8 42	8 47	8 48	8 50	8 53	8 55	8 58
	13	9 00	9 00	9 00	9 00	8 59	8 59	8 59	8 59	8 59	8 59	8 58	8 58	8 58
	14	9 40	9 35	9 31	9 26	9 23	9 19	9 15	9 11	9 09	9 07	9 04	9 01	8 58
	15	10 20	10 11	10 03	9 53	9 47	9 41	9 33	9 24	9 20	9 16	9 11	9 05	8 59
	16	11 02	10 50	10 37	10 22	10 14	10 04	9 53	9 40	9 33	9 26	9 19	9 10	9 01

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	9 26	9 39	9 52	10 08	10 17	10 27	10 39	10 53	11 00	11 07	11 15	11 24	11 35
	1	10 18	10 26	10 35	10 45	10 50	10 57	11 04	11 13	11 17	11 22	11 27	11 32	11 38
	2	11 07	11 11	11 14	11 18	11 21	11 23	11 26	11 30	11 32	11 34	11 36	11 38	11 40
	3	11 55	11 54	11 52	11 51	11 50	11 49	11 47	11 46	11 45	11 44	11 44	11 43	11 42
	4	12 43	12 37	12 30	12 23	12 19	12 14	12 08	12 02	11 59	11 56	11 52	11 48	11 43
	5	13 32	13 22	13 10	12 57	12 50	12 41	12 31	12 19	12 14	12 08	12 01	11 54	11 45
	6	14 24	14 09	13 53	13 35	13 24	13 12	12 58	12 41	12 33	12 24	12 14	12 03	11 49
	7	15 19	15 00	14 40	14 17	14 05	13 49	13 31	13 09	12 58	12 46	12 32	12 16	11 57
	8	16 16	15 55	15 32	15 06	14 51	14 34	14 12	13 46	13 33	13 18	13 01	12 40	12 13
	9	17 13	16 52	16 28	16 01	15 45	15 26	15 04	14 35	14 21	14 05	13 45	13 21	12 49
	10	18 10	17 49	17 26	17 00	16 45	16 26	16 05	15 37	15 23	15 07	14 49	14 25	13 55
	11	19 04	18 45	18 24	18 01	17 47	17 31	17 11	16 47	16 35	16 22	16 06	15 47	15 24
	12	19 54	19 38	19 21	19 01	18 50	18 36	18 20	18 01	17 51	17 41	17 29	17 15	16 58
	13	20 40	20 28	20 15	20 00	19 51	19 41	19 29	19 14	19 07	18 59	18 51	18 41	18 30
	14	21 23	21 15	21 06	20 56	20 50	20 43	20 35	20 25	20 20	20 15	20 10	20 04	19 57
	15	22 04	22 00	21 55	21 49	21 46	21 43	21 39	21 33	21 31	21 29	21 26	21 23	21 19
	16	22 43	22 43	22 43	22 42	22 42	22 42	22 41	22 41	22 41	22 40	22 40	22 40	22 39
	17	23 23	23 26	23 30	23 35	23 37	23 40	23 44	23 48	23 50	23 52	23 54	23 57	...
	18	...	...	...	...	...	...	...	...	...	...	...	...	0 00
	19	0 03	0 11	0 19	0 28	0 34	0 40	0 47	0 56	1 00	1 05	1 10	1 15	1 21
	20	0 45	0 57	1 10	1 24	1 32	1 42	1 53	2 06	2 13	2 20	2 28	2 37	2 47
	21	1 31	1 47	2 03	2 22	2 33	2 46	3 01	3 20	3 28	3 38	3 50	4 03	4 18
	22	2 21	2 40	3 00	3 23	3 36	3 52	4 11	4 34	4 46	4 59	5 14	5 31	5 53
	23	3 16	3 37	3 59	4 26	4 41	4 59	5 20	5 47	6 01	6 16	6 34	6 56	7 25
	24	4 15	4 37	5 00	5 28	5 43	6 01	6 24	6 53	7 06	7 23	7 42	8 06	8 37
	25	5 16	5 37	5 59	6 25	6 40	6 58	7 19	7 45	7 58	8 13	8 30	8 51	9 17
	26	6 16	6 35	6 54	7 17	7 30	7 45	8 03	8 25	8 35	8 47	9 01	9 16	9 35
	27	7 14	7 29	7 45	8 02	8 12	8 24	8 38	8 54	9 02	9 11	9 20	9 31	9 43
	28	8 09	8 19	8 30	8 42	8 49	8 57	9 06	9 17	9 22	9 27	9 33	9 40	9 48
	29	9 01	9 06	9 12	9 18	9 21	9 25	9 30	9 35	9 38	9 40	9 43	9 47	9 50
Feb.	30	9 51	9 51	9 51	9 52	9 52	9 52	9 52	9 52	9 52	9 52	9 52	9 52	9 52
	31	10 40	10 35	10 30	10 24	10 21	10 17	10 13	10 08	10 05	10 03	10 00	9 57	9 53
	1	11 30	11 20	11 10	10 58	10 52	10 44	10 35	10 25	10 20	10 15	10 09	10 02	9 55
	2	12 21	12 07	11 52	11 35	11 25	11 14	11 01	10 45	10 38	10 29	10 20	10 10	9 58
	3	13 14	12 57	12 37	12 16	12 03	11 49	11 32	11 10	11 00	10 49	10 36	10 21	10 04
	4	14 10	13 49	13 27	13 02	12 47	12 30	12 10	11 44	11 31	11 17	11 01	10 41	10 16
	5	15 06	14 44	14 21	13 54	13 38	13 20	12 57	12 28	12 14	11 58	11 39	11 15	10 43
	6	16 03	15 41	15 18	14 51	14 35	14 16	13 54	13 25	13 11	12 55	12 35	12 11	11 39
	7	16 57	16 37	16 15	15 50	15 36	15 19	14 58	14 32	14 20	14 05	13 48	13 28	13 02
	8	17 48	17 30	17 12	16 51	16 38	16 24	16 06	15 45	15 34	15 23	15 09	14 54	14 35
	9	18 35	18 21	18 07	17 49	17 40	17 28	17 15	16 58	16 51	16 42	16 32	16 21	16 08
	10	19 19	19 09	18 59	18 46	18 39	18 31	18 22	18 10	18 05	17 59	17 52	17 45	17 36
	11	20 00	19 55	19 48	19 41	19 37	19 32	19 27	19 20	19 17	19 13	19 10	19 05	19 01
	12	20 40	20 38	20 36	20 34	20 33	20 32	20 30	20 28	20 27	20 26	20 25	20 23	20 22
	13	21 19	21 22	21 24	21 27	21 28	21 30	21 32	21 35	21 36	21 37	21 39	21 40	21 42
	14	21 59	22 05	22 12	22 20	22 24	22 29	22 35	22 42	22 46	22 49	22 53	22 58	23 03
	15	22 40	22 50	23 01	23 14	23 21	23 29	23 39	23 51	23 57	...	...	...	...
	16	23 23	23 38	23 53	...	...	...	...	...	...	0 03	0 10	0 17	0 26

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	10 20	10 11	10 03	9 53	9 47	9 41	9 33	9 24	9 20	9 16	9 11	9 05	8 59
	16	11 02	10 50	10 37	10 22	10 14	10 04	9 53	9 40	9 33	9 26	9 19	9 10	9 01
	17	11 47	11 32	11 15	10 56	10 45	10 32	10 17	9 59	9 50	9 41	9 30	9 18	9 04
	18	12 37	12 18	11 58	11 34	11 21	11 06	10 47	10 24	10 14	10 01	9 47	9 31	9 11
	19	13 30	13 09	12 47	12 20	12 06	11 48	11 26	11 00	10 47	10 32	10 14	9 53	9 26
	20	14 28	14 06	13 42	13 15	12 59	12 40	12 18	11 49	11 35	11 18	10 59	10 34	10 02
	21	15 28	15 07	14 44	14 17	14 02	13 44	13 22	12 54	12 40	12 25	12 06	11 43	11 13
	22	16 28	16 09	15 49	15 25	15 12	14 56	14 37	14 13	14 02	13 49	13 34	13 16	12 54
	23	17 26	17 11	16 56	16 37	16 26	16 14	15 59	15 41	15 33	15 23	15 12	15 00	14 45
	24	18 22	18 12	18 01	17 49	17 41	17 33	17 23	17 12	17 06	17 00	16 53	16 45	16 37
	25	19 16	19 11	19 05	18 59	18 56	18 52	18 47	18 41	18 39	18 36	18 33	18 29	18 25
	26	20 07	20 07	20 08	20 08	20 08	20 09	20 09	20 09	20 10	20 10	20 10	20 10	20 11
	27	20 58	21 04	21 10	21 17	21 20	21 25	21 30	21 37	21 40	21 43	21 47	21 51	21 55
	28	21 50	22 00	22 12	22 25	22 32	22 41	22 51	23 03	23 09	23 16	23 23	23 31	23 40
	Mar. 1	22 43	22 58	23 14	23 33	23 44	23 56	...	...	...	...	...	...	...
	2	23 38	23 57	...	...	...	...	0 11	0 29	0 38	0 48	0 59	1 12	1 27
	3	...	...	0 17	0 40	0 54	1 09	1 28	1 53	2 04	2 17	2 32	2 51	3 13
	4	0 35	0 56	1 19	1 45	2 00	2 18	2 40	3 08	3 22	3 38	3 57	4 20	4 51
	5	1 31	1 53	2 17	2 45	3 01	3 20	3 43	4 12	4 27	4 43	5 04	5 29	6 03
	6	2 27	2 49	3 12	3 39	3 54	4 12	4 34	5 02	5 15	5 31	5 49	6 12	6 41
	7	3 20	3 40	4 00	4 25	4 38	4 55	5 14	5 38	5 50	6 03	6 18	6 36	6 58
	8	4 10	4 26	4 44	5 04	5 16	5 29	5 45	6 05	6 14	6 24	6 36	6 49	7 05
	9	4 56	5 09	5 23	5 39	5 48	5 58	6 10	6 25	6 32	6 39	6 48	6 57	7 08
	10	5 39	5 48	5 58	6 09	6 15	6 22	6 31	6 41	6 45	6 50	6 56	7 02	7 09
	11	6 20	6 25	6 30	6 37	6 40	6 44	6 49	6 54	6 57	7 00	7 03	7 06	7 10
	12	6 59	7 00	7 01	7 03	7 03	7 04	7 05	7 06	7 07	7 07	7 08	7 09	7 10
	13	7 38	7 35	7 32	7 28	7 26	7 24	7 21	7 18	7 17	7 15	7 14	7 12	7 10
	14	8 18	8 11	8 03	7 55	7 50	7 45	7 38	7 31	7 27	7 24	7 19	7 15	7 10
	15	8 59	8 48	8 36	8 23	8 16	8 07	7 57	7 45	7 39	7 33	7 27	7 19	7 10
	16	9 43	9 28	9 12	8 55	8 44	8 33	8 19	8 02	7 55	7 46	7 36	7 25	7 12
	17	10 30	10 12	9 53	9 30	9 18	9 03	8 46	8 25	8 14	8 03	7 50	7 35	7 17
	18	11 21	11 00	10 38	10 13	9 58	9 41	9 20	8 55	8 42	8 28	8 12	7 52	7 27
	19	12 15	11 53	11 30	11 03	10 47	10 28	10 05	9 37	9 22	9 06	8 47	8 23	7 51
	20	13 13	12 51	12 27	12 00	11 44	11 25	11 02	10 33	10 19	10 02	9 42	9 18	8 44
	21	14 11	13 51	13 29	13 04	12 49	12 31	12 11	11 44	11 31	11 17	11 00	10 39	10 12
	22	15 09	14 51	14 33	14 12	14 00	13 45	13 28	13 07	12 57	12 45	12 32	12 16	11 58
	23	16 05	15 52	15 38	15 22	15 13	15 02	14 50	14 35	14 27	14 19	14 11	14 00	13 49
	24	16 59	16 51	16 42	16 33	16 27	16 21	16 13	16 04	16 00	15 56	15 51	15 45	15 38
	25	17 51	17 49	17 46	17 43	17 41	17 39	17 37	17 34	17 33	17 31	17 30	17 28	17 26
	26	18 43	18 46	18 49	18 53	18 55	18 57	19 00	19 03	19 05	19 07	19 09	19 11	19 13
	27	19 36	19 44	19 53	20 03	20 09	20 16	20 24	20 33	20 38	20 43	20 48	20 54	21 01
	28	20 30	20 44	20 58	21 14	21 23	21 34	21 48	22 03	22 11	22 19	22 29	22 40	22 52
	29	21 27	21 44	22 03	22 25	22 37	22 52	23 10	23 32	23 43	23 55	...	...	...
	30	22 25	22 46	23 08	23 34	23 49	...	...	...	...	...	0 08	0 25	0 44
	31	23 24	23 46	...	...	...	0 06	0 27	0 55	1 08	1 23	1 41	2 03	2 32
Apr.	1	0 10	0 38	0 54	1 13	1 36	2 06	2 20	2 37	2 58	3 23	3 59
	2	0 22	0 44	1 07	1 35	1 51	2 09	2 32	3 01	3 15	3 32	3 51	4 16	4 48

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	22 40	22 50	23 01	23 14	23 21	23 29	23 39	23 51	23 57	0 03	0 10	0 17	0 26
	16	23 23	23 38	23 53	0 03	0 10	0 17	0 26
	17	0 10	0 20	0 32	0 45	1 02	1 10	1 19	1 29	1 41	1 54
	18	0 11	0 28	0 47	1 09	1 21	1 36	1 53	2 15	2 26	2 37	2 51	3 07	3 26
	19	1 02	1 22	1 44	2 09	2 24	2 41	3 02	3 28	3 40	3 55	4 12	4 33	4 59
	20	1 58	2 19	2 43	3 10	3 26	3 44	4 07	4 35	4 50	5 06	5 25	5 49	6 21
	21	2 56	3 18	3 42	4 09	4 24	4 43	5 05	5 33	5 47	6 03	6 22	6 45	7 15
	22	3 57	4 17	4 38	5 03	5 17	5 34	5 54	6 18	6 30	6 44	6 59	7 18	7 40
	23	4 56	5 13	5 31	5 51	6 03	6 16	6 32	6 52	7 01	7 11	7 23	7 36	7 52
	24	5 53	6 06	6 19	6 34	6 43	6 52	7 04	7 17	7 24	7 31	7 39	7 47	7 57
	25	6 48	6 55	7 03	7 12	7 17	7 23	7 30	7 38	7 41	7 45	7 50	7 55	8 00
	26	7 40	7 42	7 45	7 48	7 49	7 51	7 53	7 55	7 56	7 58	7 59	8 00	8 02
	27	8 31	8 28	8 25	8 22	8 20	8 17	8 15	8 12	8 10	8 09	8 07	8 05	8 03
	28	9 23	9 15	9 06	8 56	8 51	8 45	8 37	8 29	8 25	8 20	8 16	8 10	8 04
Mar.	1	10 15	10 02	9 49	9 33	9 24	9 14	9 02	8 48	8 42	8 34	8 26	8 17	8 07
	2	11 09	10 52	10 34	10 13	10 02	9 48	9 32	9 12	9 03	8 52	8 40	8 27	8 11
	3	12 05	11 45	11 23	10 59	10 45	10 28	10 08	9 43	9 31	9 18	9 02	8 43	8 20
	4	13 02	12 40	12 17	11 50	11 34	11 15	10 53	10 25	10 11	9 55	9 35	9 12	8 41
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	3	13 41	13 22	13 02	12 37	12 23	12 07	11 47	11 22	11 10	10 57	10 40	10 21	9 57
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	7	16 39	16 34	16 29	16 24	16 20	16 17	16 12	16 07	16 05	16 02	15 59	15 56	15 53
	8	17 18	17 17	17 17	17 16	17 16	17 16	17 15	17 15	17 14	17 14	17 14	17 14	17 13
	9	17 57	18 00	18 04	18 09	18 11	18 14	18 18	18 22	18 24	18 26	18 28	18 31	18 34
	10	18 37	18 44	18 53	19 02	19 08	19 14	19 21	19 30	19 34	19 39	19 44	19 50	19 56
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	13	20 50	21 09	21 29	21 52	22 06	22 21	22 40	23 04	23 15	23 28	23 43
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	28	22 43	23 00	23 19	23 39	23 51	0 12	0 24	0 38	0 54	1 12	1 36
	29	23 31	23 45	23 59	0 05	0 21	0 41	0 50	1 01	1 13	1 27	1 43
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	31	0 15	0 24	0 34	0 46	0 52	0 59	1 08	1 18	1 23	1 28	1 33	1 40	1 47
June	1	0 56	1 01	1 07	1 13	1 17	1 21	1 26	1 31	1 34	1 37	1 40	1 43	1 47
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July	1	0 51	0 45	0 39	0 32	0 29	0 24	0 20	0 14	0 11	0 08	0 05	0 01	23 58
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

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Aug.	31	0 53	0 37	0 20	0 01	23 52	23 29	23 18	23 06	22 52	22 35	22 16
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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Aug.	16	2 43	2 21	1 57	1 28	1 12	0 53	0 29	0 00	23 48	23 14
	17	3 42	3 20	2 57	2 29	2 14	1 55	1 32	1 03	0 49	0 32	0 12
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	19	5 29	5 13	4 56	4 35	4 24	4 10	3 54	3 34	3 25	3 14	3 02	2 48	2 31
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	26	10 24	10 36	10 50	11 05	11 14	11 25	11 37	11 52	11 59	12 07	12 15	12 25	12 37
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Sept.	31	14 39	15 01	15 24	15 51	16 06	16 25	16 47	17 15	17 29	17 45	18 03	18 26	18 56
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	3	5 21	5 20	5 18	5 17	5 16	5 14	5 13	5 11	5 11	5 10	5 09	5 08	5 07
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	7	8 59	9 18	9 38	10 01	10 15	10 31	10 50	11 14	11 25	11 38	11 54	12 12	12 34
	8	10 00	10 22	10 45	11 12	11 27	11 46	12 09	12 38	12 52	13 08	13 28	13 53	14 26
	9	11 01	11 24	11 49	12 17	12 33	12 53	13 17	13 48	14 03	14 21	14 42	15 10	15 49
	10	12 01	12 23	12 47	13 14	13 30	13 49	14 11	14 40	14 55	15 11	15 30	15 54	16 26
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	17	17 19	17 15	17 11	17 07	17 04	17 01	16 58	16 54	16 52	16 50	16 47	16 45	16 42
	18	17 59	17 51	17 42	17 33	17 28	17 21	17 14	17 06	17 02	16 58	16 53	16 48	16 42
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	27	0 34	0 17	23 48	23 41	23 32	23 22	23 10	22 57
	28	1 26	1 12	0 58	0 40	0 30	0 19	0 05
	29	2 17	2 08	1 58	1 46	1 40	1 32	1 23	1 12	1 07	1 02	0 56	0 49	0 41
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Nov.	31	3 57	3 58	3 59	4 00	4 01	4 02	4 03	4 04	4 04	4 05	4 06	4 07	4 07
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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	10	23 44	23 17	23 02	22 44	22 22	21 54	21 39	21 23	21 04	20 40	20 09
	11	0 28	0 07	23 52	23 33	23 09	22 58	22 45	22 30	22 12	21 50
	12	1 22	1 04	0 44	0 21	0 07	23 57	23 44	23 29
	13	2 12	1 57	1 41	1 22	1 11	0 59	0 44	0 26	0 17	0 08
	14	2 57	2 46	2 34	2 21	2 13	2 04	1 54	1 41	1 35	1 28	1 21	1 12	1 03
	15	3 39	3 32	3 25	3 17	3 12	3 07	3 00	2 53	2 49	2 45	2 41	2 36	2 30
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LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
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Nov.	16	17 22	17 07	16 52	16 34	16 25	16 13	16 00	15 43	15 36	15 27	15 18	15 07	14 55
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	23	23 41	23 38	23 35	23 31	23 29	23 27	23 24	23 20	23 19	23 17	23 15	23 13	23 11
	24
	25	0 28	0 30	0 32	0 34	0 35	0 37	0 39	0 41	0 42	0 43	0 45	0 46	0 48
	26	1 16	1 23	1 30	1 39	1 44	1 50	1 56	2 04	2 08	2 12	2 17	2 22	2 28
	27	2 07	2 19	2 32	2 47	2 55	3 05	3 17	3 31	3 38	3 45	3 54	4 03	4 14
	28	3 03	3 19	3 37	3 58	4 09	4 23	4 40	5 01	5 11	5 22	5 35	5 49	6 07
	29	4 03	4 23	4 45	5 10	5 25	5 42	6 03	6 30	6 43	6 58	7 15	7 37	8 04
	30	5 07	5 29	5 53	6 21	6 37	6 57	7 20	7 50	8 05	8 23	8 44	9 10	9 48
	31	6 11	6 34	6 58	7 26	7 42	8 01	8 24	8 54	9 09	9 26	9 47	10 12	10 47
	32	7 13	7 34	7 56	8 22	8 36	8 53	9 14	9 40	9 53	10 07	10 23	10 43	11 08

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	+10°	+20°	+30°	+35°	+40°	+45°	+50°	+52°	+54°	+56°	+58°	+60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	4 59	5 12	5 26	5 41	5 50	6 00	6 12	6 27	6 34	6 42	6 51	7 01	7 12
	17	5 44	6 00	6 17	6 38	6 49	7 03	7 19	7 39	7 48	7 59	8 11	8 25	8 42
	18	6 31	6 50	7 11	7 36	7 49	8 06	8 25	8 50	9 02	9 16	9 32	9 51	10 15
	19	7 21	7 43	8 06	8 33	8 49	9 07	9 29	9 58	10 12	10 28	10 48	11 12	11 44
	20	8 14	8 37	9 01	9 29	9 45	10 05	10 28	10 58	11 13	11 30	11 51	12 17	12 54
	21	9 08	9 30	9 54	10 21	10 37	10 56	11 18	11 47	12 01	12 17	12 36	13 00	13 32
	22	10 02	10 22	10 44	11 08	11 22	11 39	11 59	12 24	12 36	12 50	13 06	13 24	13 47
	23	10 54	11 11	11 29	11 50	12 02	12 16	12 32	12 52	13 01	13 12	13 24	13 37	13 54
	24	11 44	11 57	12 11	12 27	12 36	12 46	12 59	13 13	13 20	13 28	13 36	13 45	13 56
	25	12 32	12 41	12 50	13 01	13 07	13 13	13 21	13 30	13 35	13 39	13 45	13 51	13 57
	26	13 20	13 24	13 28	13 33	13 35	13 38	13 42	13 46	13 48	13 50	13 52	13 54	13 57
	27	14 08	14 07	14 06	14 04	14 04	14 03	14 02	14 00	14 00	13 59	13 58	13 58	13 57
	28	14 58	14 52	14 45	14 37	14 33	14 28	14 22	14 15	14 12	14 09	14 05	14 01	13 57
	29	15 51	15 39	15 27	15 13	15 06	14 57	14 46	14 33	14 27	14 21	14 14	14 06	13 57
	30	16 48	16 32	16 15	15 55	15 44	15 31	15 15	14 56	14 47	14 38	14 26	14 14	13 59
Dec.	1	17 50	17 30	17 09	16 44	16 29	16 13	15 53	15 28	15 16	15 02	14 47	14 28	14 05
	2	18 55	18 32	18 09	17 40	17 24	17 05	16 42	16 13	15 58	15 42	15 21	14 57	14 23
	3	20 00	19 37	19 13	18 44	18 28	18 08	17 45	17 14	16 59	16 41	16 20	15 53	15 14
	4	21 01	20 40	20 18	19 52	19 37	19 19	18 57	18 29	18 16	18 00	17 42	17 19	16 49
	5	21 58	21 40	21 21	20 59	20 46	20 31	20 13	19 51	19 40	19 28	19 14	18 57	18 37
	6	22 48	22 34	22 20	22 03	21 53	21 41	21 28	21 11	21 03	20 55	20 45	20 33	20 20
	7	23 34	23 25	23 14	23 03	22 56	22 48	22 39	22 28	22 22	22 17	22 10	22 03	21 55
	8	...	...	...	23 59	23 55	23 51	23 46	23 40	23 37	23 34	23 31	23 27	23 23
	9	0 17	0 11	0 06	...	...	...	...	...	...	...	...	...	...
	10	0 57	0 56	0 55	0 53	0 53	0 52	0 51	0 50	0 49	0 48	0 48	0 47	0 46
	11	1 36	1 39	1 43	1 47	1 49	1 51	1 54	1 58	1 59	2 01	2 03	2 05	2 08
	12	2 16	2 23	2 31	2 40	2 45	2 51	2 58	3 06	3 10	3 14	3 19	3 24	3 30
	13	2 57	3 08	3 20	3 34	3 42	3 51	4 02	4 15	4 21	4 28	4 36	4 45	4 55
	14	3 40	3 55	4 11	4 30	4 41	4 53	5 08	5 26	5 35	5 45	5 56	6 08	6 23
	15	4 26	4 45	5 05	5 28	5 41	5 56	6 15	6 38	6 49	7 02	7 16	7 34	7 55
	16	5 16	5 37	6 00	6 26	6 41	6 59	7 20	7 48	8 01	8 17	8 35	8 58	9 27
	17	6 09	6 31	6 55	7 23	7 39	7 58	8 21	8 51	9 06	9 23	9 44	10 09	10 45
	18	7 03	7 26	7 50	8 17	8 33	8 52	9 15	9 44	9 59	10 15	10 35	11 00	11 33
	19	7 58	8 19	8 41	9 06	9 21	9 38	9 59	10 25	10 38	10 52	11 09	11 29	11 54
	20	8 51	9 09	9 28	9 50	10 02	10 17	10 34	10 56	11 06	11 17	11 30	11 45	12 03
	21	9 41	9 56	10 11	10 28	10 38	10 49	11 03	11 19	11 26	11 34	11 44	11 54	12 06
	22	10 30	10 40	10 50	11 02	11 09	11 17	11 26	11 37	11 42	11 47	11 53	12 00	12 08
	23	11 17	11 22	11 28	11 34	11 38	11 42	11 46	11 52	11 55	11 58	12 01	12 04	12 08
	24	12 03	12 03	12 04	12 05	12 05	12 05	12 06	12 06	12 06	12 07	12 07	12 07	12 07
	25	12 50	12 46	12 41	12 36	12 33	12 29	12 25	12 20	12 18	12 16	12 13	12 10	12 07
	26	13 40	13 30	13 20	13 09	13 03	12 55	12 47	12 36	12 32	12 27	12 21	12 14	12 07
	27	14 33	14 19	14 04	13 46	13 37	13 25	13 12	12 56	12 49	12 40	12 31	12 21	12 09
	28	15 31	15 12	14 53	14 30	14 17	14 02	13 44	13 22	13 12	13 00	12 47	12 31	12 12
	29	16 33	16 12	15 49	15 22	15 07	14 49	14 27	14 00	13 46	13 31	13 13	12 51	12 23
	30	17 38	17 15	16 51	16 22	16 06	15 46	15 22	14 52	14 37	14 19	13 58	13 32	12 54
	31	18 41	18 19	17 56	17 28	17 13	16 54	16 31	16 01	15 47	15 30	15 10	14 45	14 10
	32	19 41	19 22	19 01	18 37	18 23	18 07	17 47	17 22	17 10	16 56	16 40	16 20	15 56

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	21 53	22 04	22 16	22 29	22 36	22 44	22 54	23 06	23 11	23 17	23 24	23 31	23 40
	1	22 44	22 50	22 56	23 03	23 07	23 12	23 17	23 24	23 27	23 30	23 34	23 37	23 42
	2	23 32	23 33	23 35	23 36	23 37	23 38	23 39	23 40	23 40	23 41	23 42	23 43	23 43
	3	...	...	...	...	...	...	...	23 56	23 54	23 52	23 50	23 47	23 45
	4	0 20	0 16	0 12	0 08	0 06	0 03	0 00	...	...	...	23 59	23 53	23 47
	5	1 09	1 00	0 51	0 41	0 35	0 29	0 21	0 12	0 08	0 04	...	...	23 50
	6	1 59	1 46	1 32	1 17	1 08	0 58	0 46	0 32	0 25	0 18	0 09	0 00	23 56
	7	2 52	2 35	2 17	1 57	1 45	1 32	1 16	0 56	0 47	0 36	0 25	0 11	...
	8	3 48	3 28	3 07	2 42	2 28	2 12	1 53	1 28	1 16	1 03	0 48	0 30	0 07
	9	4 46	4 24	4 01	3 34	3 19	3 01	2 39	2 11	1 58	1 42	1 24	1 01	0 32
	10	5 43	5 21	4 58	4 31	4 16	3 57	3 35	3 07	2 53	2 37	2 18	1 54	1 23
	11	6 39	6 18	5 57	5 31	5 17	5 00	4 39	4 13	4 00	3 46	3 29	3 08	2 42
	12	7 31	7 13	6 54	6 32	6 20	6 05	5 47	5 25	5 15	5 03	4 49	4 33	4 14
	13	8 19	8 04	7 49	7 31	7 22	7 10	6 56	6 39	6 31	6 22	6 12	6 00	5 47
	14	9 03	8 53	8 41	8 29	8 21	8 13	8 03	7 51	7 45	7 39	7 32	7 24	7 15
	15	9 45	9 38	9 31	9 23	9 19	9 14	9 08	9 01	8 57	8 54	8 50	8 45	8 40
	16	10 24	10 22	10 20	10 17	10 15	10 13	10 11	10 08	10 07	10 06	10 04	10 03	10 01
	17	11 04	11 05	11 07	11 09	11 10	11 12	11 13	11 15	11 16	11 17	11 18	11 19	11 21
	18	11 43	11 49	11 55	12 02	12 06	12 11	12 16	12 23	12 26	12 29	12 33	12 37	12 42
	19	12 25	12 34	12 45	12 57	13 04	13 11	13 21	13 32	13 37	13 43	13 50	13 57	14 06
	20	13 09	13 22	13 37	13 54	14 03	14 15	14 28	14 44	14 52	15 01	15 10	15 21	15 34
	21	13 57	14 14	14 32	14 53	15 06	15 20	15 37	15 59	16 09	16 21	16 34	16 50	17 08
	22	14 49	15 09	15 31	15 55	16 10	16 27	16 48	17 13	17 26	17 41	17 58	18 18	18 44
	23	15 46	16 08	16 31	16 58	17 14	17 32	17 55	18 23	18 38	18 54	19 14	19 38	20 10
	24	16 46	17 08	17 32	17 58	18 14	18 32	18 55	19 23	19 37	19 53	20 12	20 35	21 06
	25	17 47	18 07	18 29	18 53	19 08	19 24	19 44	20 09	20 21	20 35	20 51	21 09	21 32
	26	18 47	19 04	19 22	19 42	19 54	20 07	20 23	20 43	20 52	21 03	21 14	21 28	21 44
	27	19 44	19 56	20 09	20 25	20 33	20 43	20 55	21 08	21 15	21 22	21 30	21 39	21 49
	28	20 37	20 45	20 53	21 02	21 07	21 13	21 20	21 28	21 32	21 36	21 41	21 46	21 52
	29	21 28	21 30	21 33	21 36	21 38	21 40	21 43	21 46	21 47	21 48	21 50	21 52	21 54
Feb.	30	22 17	22 15	22 12	22 09	22 08	22 06	22 04	22 02	22 01	21 59	21 58	21 57	21 55
	31	23 06	22 59	22 51	22 42	22 38	22 32	22 26	22 18	22 14	22 11	22 06	22 02	21 57
	1	23 56	23 44	23 32	23 18	23 10	23 00	22 49	22 36	22 30	22 24	22 16	22 08	21 59
	2	...	...	...	23 56	23 45	23 32	23 17	22 59	22 50	22 41	22 30	22 18	22 04
	3	0 48	0 32	0 15	...	...	...	23 51	23 28	23 17	23 04	22 50	22 33	22 13
	4	1 43	1 24	1 03	0 39	0 26	0 10	...	...	23 54	23 38	23 21	22 59	22 32
	5	2 39	2 18	1 55	1 28	1 13	0 56	0 34	0 07	...	...	...	23 44	23 12
	6	3 36	3 14	2 50	2 23	2 07	1 49	1 26	0 58	0 43	0 27	0 08	...	...
	7	4 31	4 10	3 48	3 21	3 06	2 49	2 27	2 00	1 47	1 31	1 13	0 51	0 22
	8	5 24	5 05	4 45	4 22	4 08	3 53	3 34	3 10	2 59	2 46	2 31	2 13	1 51
	9	6 13	5 57	5 40	5 21	5 10	4 57	4 42	4 23	4 14	4 04	3 53	3 40	3 24
	10	6 58	6 46	6 34	6 19	6 11	6 01	5 50	5 36	5 29	5 22	5 14	5 05	4 55
	11	7 41	7 33	7 24	7 15	7 09	7 03	6 56	6 47	6 42	6 38	6 33	6 27	6 21
	12	8 21	8 17	8 13	8 09	8 06	8 03	8 00	7 55	7 53	7 51	7 49	7 46	7 43
	13	9 00	9 01	9 01	9 01	9 02	9 02	9 02	9 03	9 03	9 03	9 03	9 03	9 04
	14	9 40	9 44	9 49	9 54	9 57	10 01	10 05	10 10	10 12	10 14	10 17	10 20	10 24
	15	10 20	10 28	10 37	10 48	10 53	11 00	11 08	11 18	11 22	11 27	11 33	11 39	11 46
	16	11 02	11 14	11 28	11 43	11 51	12 01	12 13	12 28	12 35	12 42	12 51	13 01	13 11

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan.	0	9 26	9 13	8 59	8 42	8 33	8 22	8 09	7 53	7 46	7 38	7 28	7 18	7 05
	1	10 18	10 09	10 00	9 50	9 44	9 37	9 28	9 18	9 14	9 09	9 03	8 57	8 50
	2	11 07	11 03	10 59	10 55	10 52	10 49	10 46	10 42	10 40	10 38	10 35	10 33	10 30
	3	11 55	11 56	11 58	11 59	12 00	12 01	12 02	12 04	12 04	12 05	12 06	12 07	12 08
	4	12 43	12 49	12 56	13 03	13 08	13 13	13 18	13 25	13 28	13 32	13 36	13 40	13 45
	5	13 32	13 43	13 55	14 08	14 16	14 25	14 35	14 48	14 54	15 00	15 07	15 15	15 25
	6	14 24	14 39	14 55	15 14	15 25	15 37	15 52	16 10	16 19	16 29	16 40	16 52	17 07
	7	15 19	15 37	15 57	16 21	16 34	16 49	17 08	17 32	17 43	17 56	18 11	18 28	18 50
	8	16 16	16 37	16 59	17 25	17 40	17 58	18 19	18 47	19 00	19 15	19 34	19 56	20 24
	9	17 13	17 35	17 58	18 26	18 41	19 00	19 22	19 50	20 04	20 20	20 40	21 03	21 34
	10	18 10	18 31	18 54	19 20	19 34	19 52	20 13	20 40	20 53	21 08	21 25	21 46	22 12
	11	19 04	19 23	19 43	20 06	20 19	20 35	20 54	21 16	21 27	21 39	21 54	22 10	22 30
	12	19 54	20 10	20 27	20 46	20 57	21 10	21 25	21 43	21 52	22 01	22 12	22 24	22 38
	13	20 40	20 53	21 06	21 21	21 29	21 38	21 50	22 03	22 09	22 16	22 24	22 33	22 42
	14	21 23	21 32	21 41	21 51	21 56	22 03	22 10	22 19	22 23	22 28	22 33	22 38	22 45
	15	22 04	22 08	22 13	22 18	22 21	22 24	22 28	22 33	22 35	22 37	22 40	22 43	22 46
	16	22 43	22 44	22 44	22 44	22 45	22 45	22 45	22 45	22 45	22 46	22 46	22 46	22 46
	17	23 23	23 19	23 15	23 10	23 08	23 05	23 02	22 58	22 56	22 54	22 52	22 49	22 47
	18	...	23 55	23 47	23 38	23 32	23 26	23 19	23 11	23 07	23 03	22 58	22 53	22 47
	19	0 03	...	...	...	23 59	23 50	23 39	23 26	23 20	23 14	23 06	22 58	22 49
	20	0 45	0 34	0 21	0 07	...	...	...	23 46	23 37	23 28	23 18	23 06	22 52
	21	1 31	1 16	1 00	0 41	0 30	0 18	0 03	...	...	23 48	23 34	23 18	22 59
	22	2 21	2 03	1 43	1 20	1 07	0 52	0 33	0 11	0 00	...	...	23 40	23 14
	23	3 16	2 55	2 33	2 07	1 52	1 34	1 13	0 46	0 33	0 18	0 01	...	23 49
	24	4 15	3 53	3 29	3 02	2 46	2 27	2 05	1 36	1 21	1 05	0 46	0 21	...
	25	5 16	4 54	4 31	4 05	3 50	3 32	3 10	2 42	2 28	2 12	1 53	1 30	1 00
	26	6 16	5 58	5 37	5 14	5 01	4 45	4 25	4 02	3 50	3 37	3 21	3 03	2 41
	27	7 14	7 00	6 43	6 25	6 14	6 02	5 47	5 29	5 20	5 10	5 00	4 47	4 32
	28	8 09	7 59	7 48	7 35	7 28	7 20	7 10	6 58	6 52	6 46	6 39	6 31	6 22
	29	9 01	8 56	8 50	8 44	8 40	8 36	8 31	8 25	8 22	8 19	8 15	8 11	8 07
Feb.	30	9 51	9 51	9 51	9 51	9 50	9 50	9 50	9 50	9 50	9 49	9 49	9 49	9 49
	31	10 40	10 45	10 50	10 56	11 00	11 03	11 08	11 13	11 16	11 19	11 22	11 25	11 29
	1	11 30	11 40	11 50	12 02	12 08	12 16	12 25	12 37	12 42	12 48	12 54	13 01	13 09
	2	12 21	12 35	12 50	13 07	13 17	13 29	13 43	14 00	14 08	14 16	14 26	14 38	14 51
	3	13 14	13 32	13 51	14 13	14 26	14 41	14 59	15 21	15 32	15 44	15 58	16 14	16 34
	4	14 10	14 30	14 52	15 18	15 32	15 50	16 11	16 37	16 50	17 05	17 23	17 44	18 11
	5	15 06	15 28	15 51	16 19	16 34	16 53	17 15	17 44	17 58	18 14	18 34	18 58	19 29
	6	16 03	16 24	16 47	17 14	17 29	17 47	18 09	18 37	18 51	19 06	19 24	19 47	20 16
	7	16 57	17 17	17 38	18 02	18 16	18 33	18 52	19 17	19 28	19 42	19 57	20 15	20 38
	8	17 48	18 05	18 23	18 44	18 56	19 09	19 26	19 46	19 55	20 06	20 18	20 32	20 48
	9	18 35	18 49	19 03	19 20	19 29	19 40	19 52	20 08	20 15	20 23	20 31	20 41	20 53
	10	19 19	19 29	19 39	19 51	19 58	20 05	20 14	20 25	20 30	20 35	20 41	20 48	20 55
	11	20 00	20 06	20 12	20 19	20 23	20 28	20 33	20 39	20 42	20 45	20 48	20 52	20 56
	12	20 40	20 42	20 44	20 46	20 47	20 48	20 50	20 52	20 52	20 53	20 54	20 55	20 57
	13	21 19	21 17	21 14	21 12	21 10	21 08	21 06	21 04	21 03	21 01	21 00	20 59	20 57
	14	21 59	21 52	21 46	21 38	21 34	21 29	21 23	21 16	21 13	21 10	21 06	21 02	20 57
	15	22 40	22 29	22 19	22 06	21 59	21 51	21 42	21 30	21 25	21 19	21 13	21 06	20 58
	16	23 23	23 09	22 54	22 37	22 28	22 16	22 03	21 47	21 40	21 32	21 22	21 12	21 00

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb.	15	10 20	10 28	10 37	10 48	10 53	11 00	11 08	11 18	11 22	11 27	11 33	11 39	11 46
	16	11 02	11 14	11 28	11 43	11 51	12 01	12 13	12 28	12 35	12 42	12 51	13 01	13 11
	17	11 47	12 03	12 20	12 40	12 51	13 05	13 20	13 40	13 50	14 00	14 12	14 26	14 42
	18	12 37	12 56	13 16	13 40	13 54	14 10	14 29	14 54	15 05	15 19	15 34	15 53	16 16
	19	13 30	13 52	14 15	14 41	14 56	15 14	15 37	16 05	16 18	16 34	16 54	17 17	17 48
	20	14 28	14 50	15 14	15 41	15 57	16 16	16 39	17 08	17 23	17 39	18 00	18 24	18 58
	21	15 28	15 49	16 12	16 38	16 53	17 11	17 33	18 00	18 13	18 28	18 46	19 08	19 35
	22	16 28	16 47	17 07	17 30	17 43	17 58	18 16	18 39	18 50	19 02	19 16	19 32	19 51
	23	17 26	17 41	17 57	18 15	18 25	18 37	18 51	19 08	19 16	19 25	19 34	19 46	19 59
	24	18 22	18 32	18 43	18 55	19 02	19 10	19 19	19 30	19 35	19 41	19 47	19 54	20 02
Mar.	25	19 16	19 21	19 26	19 32	19 35	19 39	19 44	19 49	19 51	19 54	19 57	20 00	20 04
	26	20 07	20 07	20 07	20 06	20 06	20 06	20 06	20 06	20 06	20 05	20 05	20 05	20 05
	27	20 58	20 53	20 47	20 40	20 37	20 33	20 28	20 22	20 20	20 17	20 14	20 10	20 06
	28	21 50	21 39	21 28	21 16	21 09	21 01	20 51	20 40	20 35	20 29	20 23	20 16	20 08
	1	22 43	22 28	22 12	21 54	21 44	21 32	21 18	21 02	20 54	20 45	20 35	20 24	20 12
	2	23 38	23 19	23 00	22 37	22 24	22 09	21 51	21 29	21 18	21 06	20 53	20 37	20 18
	3	...	...	23 51	23 25	23 10	22 52	22 31	22 05	21 52	21 37	21 20	20 59	20 33
	4	0 35	0 13	...	...	...	23 44	23 21	22 52	22 38	22 21	22 02	21 38	21 05
	5	1 31	1 09	0 46	0 18	0 02	...	...	23 51	23 37	23 21	23 02	22 38	22 07
	6	2 27	2 06	1 42	1 15	1 00	0 42	0 19	...	...	...	...	23 57	23 33
	7	3 20	3 01	2 39	2 15	2 01	1 44	1 24	0 59	0 47	0 33	0 17	...	...
	8	4 10	3 53	3 35	3 14	3 03	2 49	2 32	2 11	2 02	1 51	1 38	1 23	1 06
	9	4 56	4 43	4 28	4 12	4 03	3 52	3 39	3 24	3 17	3 08	2 59	2 49	2 37
	10	5 39	5 30	5 20	5 08	5 02	4 54	4 46	4 35	4 30	4 25	4 18	4 12	4 04
	11	6 20	6 14	6 09	6 03	5 59	5 55	5 50	5 44	5 41	5 38	5 35	5 31	5 27
	12	6 59	6 58	6 57	6 56	6 55	6 54	6 53	6 52	6 51	6 51	6 50	6 49	6 48
	13	7 38	7 41	7 44	7 48	7 50	7 53	7 56	7 59	8 01	8 02	8 04	8 06	8 09
	14	8 18	8 25	8 33	8 41	8 46	8 52	8 59	9 07	9 11	9 15	9 19	9 24	9 30
	15	8 59	9 10	9 22	9 36	9 43	9 53	10 03	10 16	10 22	10 29	10 36	10 45	10 55
	16	9 43	9 58	10 14	10 32	10 42	10 55	11 09	11 27	11 36	11 45	11 56	12 09	12 23
	17	10 30	10 48	11 07	11 30	11 43	11 58	12 17	12 40	12 51	13 03	13 18	13 35	13 56
	18	11 21	11 42	12 04	12 30	12 44	13 02	13 24	13 51	14 04	14 19	14 38	15 00	15 29
	19	12 15	12 37	13 01	13 29	13 45	14 04	14 27	14 56	15 11	15 28	15 48	16 14	16 49
	20	13 13	13 35	13 58	14 26	14 41	15 00	15 23	15 51	16 06	16 22	16 41	17 06	17 38
	21	14 11	14 31	14 53	15 18	15 32	15 49	16 09	16 34	16 47	17 01	17 17	17 36	18 00
	22	15 09	15 26	15 44	16 05	16 16	16 30	16 47	17 07	17 16	17 27	17 39	17 53	18 09
	23	16 05	16 17	16 31	16 47	16 55	17 05	17 17	17 31	17 38	17 45	17 53	18 03	18 13
	24	16 59	17 07	17 15	17 24	17 30	17 36	17 43	17 51	17 55	17 59	18 04	18 09	18 15
	25	17 51	17 54	17 57	18 00	18 01	18 03	18 06	18 08	18 10	18 11	18 12	18 14	18 16
	26	18 43	18 41	18 38	18 34	18 32	18 30	18 28	18 25	18 23	18 22	18 20	18 19	18 17
	27	19 36	19 28	19 19	19 10	19 04	18 58	18 51	18 42	18 38	18 34	18 29	18 24	18 18
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	29	21 27	21 10	20 51	20 30	20 18	20 04	19 48	19 27	19 18	19 07	18 55	18 41	18 25
	30	22 25	22 05	21 43	21 18	21 03	20 46	20 26	20 01	19 48	19 34	19 18	18 59	18 36
	31	23 24	23 02	22 38	22 11	21 55	21 36	21 14	20 45	20 31	20 14	19 55	19 31	19 00
Apr.	1	...	...	23 36	23 09	22 53	22 34	22 11	21 42	21 27	21 10	20 51	20 26	19 52
	2	0 22	0 00	...	...	23 54	23 36	23 15	22 48	22 35	22 20	22 03	21 41	21 14

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
Date														
Feb.	15	h m 22 40	h m 22 29	h m 22 19	h m 22 06	h m 21 59	h m 21 51	h m 21 42	h m 21 30	h m 21 25	h m 21 19	h m 21 13	h m 21 06	h m 20 58
	16	23 23	23 09	22 54	22 37	22 28	22 16	22 03	21 47	21 40	21 32	21 22	21 12	21 00
	17	...	23 53	23 34	23 13	23 01	22 47	22 30	22 09	21 59	21 48	21 36	21 21	21 04
	18	0 11	...	...	23 55	23 41	23 24	23 04	22 39	22 26	22 13	21 57	21 37	21 14
	19	1 02	0 42	0 20	...	...	...	23 49	23 20	22 06	22 50	22 31	22 07	21 36
	20	1 58	1 36	1 12	0 45	0 29	0 11	...	...	...	23 46	23 26	23 01	22 27
	21	2 56	2 34	2 11	1 43	1 28	1 09	0 46	0 17	0 02	...	...	...	23 56
	22	3 57	3 36	3 15	2 49	2 34	2 17	1 56	1 30	1 17	1 02	0 44	0 23	...
	23	4 56	4 39	4 21	4 00	3 47	3 33	3 15	2 54	2 44	2 32	2 19	2 03	1 45
	24	5 53	5 41	5 27	5 11	5 02	4 52	4 39	4 24	4 17	4 09	4 00	3 50	3 38
	25	6 48	6 40	6 32	6 22	6 17	6 11	6 03	5 54	5 50	5 45	5 40	5 35	5 28
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	27	8 31	8 34	8 37	8 41	8 43	8 45	8 48	8 51	8 52	8 54	8 56	8 58	9 00
	28	9 23	9 31	9 39	9 49	9 55	10 01	10 09	10 18	10 22	10 27	10 32	10 38	10 45
Mar.	1	10 15	10 28	10 42	10 57	11 06	11 17	11 29	11 44	11 52	11 59	12 08	12 18	12 30
	2	11 09	11 26	11 44	12 05	12 17	12 31	12 48	13 09	13 19	13 30	13 43	13 59	14 17
	3	12 05	12 25	12 47	13 12	13 26	13 43	14 03	14 29	14 42	14 56	15 13	15 33	15 59
	4	13 02	13 24	13 47	14 14	14 30	14 49	15 11	15 40	15 54	16 10	16 30	16 54	17 26
	5	13 58	14 20	14 44	15 11	15 27	15 45	16 08	16 37	16 51	17 07	17 26	17 50	18 21
	6	14 53	15 14	15 36	16 01	16 16	16 33	16 54	17 19	17 32	17 46	18 03	18 23	18 48
	7	15 44	16 03	16 22	16 44	16 57	17 12	17 29	17 51	18 01	18 13	18 26	18 41	18 59
	8	16 32	16 47	17 03	17 21	17 31	17 43	17 57	18 14	18 22	18 31	18 40	18 52	19 05
	9	17 17	17 28	17 40	17 53	18 01	18 09	18 20	18 32	18 37	18 44	18 51	18 58	19 07
	10	17 59	18 06	18 14	18 22	18 27	18 32	18 39	18 46	18 50	18 54	18 58	19 03	19 08
	11	18 39	18 42	18 45	18 49	18 51	18 53	18 56	18 59	19 01	19 02	19 04	19 06	19 08
	12	19 18	19 17	19 16	19 15	19 14	19 13	19 12	19 11	19 11	19 10	19 10	19 09	19 08
	13	19 57	19 52	19 47	19 41	19 37	19 33	19 29	19 23	19 21	19 18	19 15	19 12	19 08
	14	20 37	20 28	20 19	20 08	20 02	19 55	19 46	19 36	19 32	19 27	19 21	19 15	19 08
	15	21 20	21 07	20 53	20 37	20 29	20 18	20 06	19 52	19 45	19 38	19 29	19 20	19 09
	16	22 05	21 49	21 31	21 11	21 00	20 46	20 30	20 11	20 02	19 52	19 41	19 27	19 12
	17	22 54	22 34	22 14	21 50	21 36	21 20	21 01	20 37	20 25	20 12	19 58	19 40	19 18
	18	23 47	23 25	23 02	22 35	22 20	22 02	21 40	21 12	20 59	20 43	20 24	20 02	19 33
	19	...	...	23 57	23 28	23 12	22 53	22 30	22 01	21 46	21 29	21 08	20 43	20 08
	20	0 43	0 20	...	...	...	23 55	23 33	23 05	22 51	22 34	22 15	21 51	21 19
	21	1 40	1 19	0 56	0 29	0 14	...	...	...	...	23 57	23 41	23 22	22 59
	22	2 39	2 20	1 59	1 35	1 22	1 06	0 46	0 22	0 10	...	...	...	...
	23	3 35	3 20	3 04	2 45	2 34	2 22	2 07	1 48	1 39	1 29	1 18	1 05	0 50
	24	4 30	4 20	4 09	3 56	3 48	3 40	3 29	3 17	3 11	3 05	2 58	2 50	2 40
	25	5 24	5 18	5 13	5 06	5 02	4 58	4 53	4 47	4 44	4 41	4 37	4 34	4 29
	26	6 16	6 16	6 16	6 16	6 16	6 16	6 16	6 16	6 16	6 16	6 16	6 16	6 16
	27	7 08	7 14	7 20	7 26	7 30	7 35	7 40	7 46	7 49	7 52	7 56	8 00	8 04
	28	8 02	8 12	8 24	8 37	8 44	8 53	9 04	9 16	9 22	9 28	9 35	9 44	9 53
	29	8 57	9 12	9 29	9 48	9 59	10 12	10 27	10 46	10 55	11 05	11 16	11 29	11 44
	30	9 55	10 14	10 34	10 58	11 12	11 28	11 47	12 12	12 24	12 37	12 53	13 12	13 35
	31	10 53	11 15	11 38	12 05	12 20	12 39	13 01	13 29	13 43	14 00	14 19	14 42	15 14
Apr.	1	11 52	12 14	12 38	13 06	13 22	13 41	14 04	14 33	14 48	15 04	15 24	15 49	16 23
	2	12 48	13 10	13 33	13 59	14 14	14 32	14 54	15 21	15 34	15 50	16 07	16 29	16 57

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr.	1	...	...	23 36	23 09	22 53	22 34	22 11	21 42	21 27	21 10	20 51	20 26	19 52
	2	0 22	0 00	...	...	23 54	23 36	23 15	22 48	22 35	22 20	22 03	21 41	21 14
	3	1 16	0 56	0 34	0 08	...	...	...	...	23 50	23 38	23 24	23 07	22 48
	4	2 07	1 50	1 30	1 08	0 56	0 41	0 23	0 01	...	...	...	...	...
	5	2 54	2 40	2 25	2 07	1 57	1 45	1 31	1 13	1 05	0 56	0 46	0 34	0 20
	6	3 38	3 28	3 16	3 03	2 56	2 47	2 37	2 25	2 19	2 13	2 06	1 58	1 49
	7	4 19	4 13	4 06	3 58	3 53	3 48	3 42	3 34	3 31	3 27	3 23	3 18	3 13
	8	4 59	4 56	4 54	4 51	4 49	4 47	4 45	4 42	4 41	4 40	4 38	4 36	4 34
	9	5 38	5 40	5 41	5 43	5 45	5 46	5 48	5 50	5 50	5 51	5 52	5 54	5 55
	10	6 17	6 23	6 29	6 36	6 40	6 45	6 51	6 57	7 00	7 04	7 07	7 11	7 16
	11	6 58	7 08	7 18	7 31	7 37	7 45	7 55	8 06	8 11	8 17	8 24	8 31	8 40
	12	7 41	7 55	8 09	8 26	8 36	8 47	9 01	9 17	9 25	9 34	9 43	9 55	10 08
	13	8 27	8 44	9 02	9 24	9 36	9 51	10 08	10 29	10 40	10 51	11 05	11 20	11 39
	14	9 16	9 36	9 58	10 23	10 37	10 54	11 15	11 41	11 54	12 08	12 26	12 46	13 13
	15	10 09	10 31	10 54	11 22	11 37	11 56	12 19	12 48	13 03	13 19	13 39	14 05	14 39
	16	11 04	11 27	11 51	12 19	12 34	12 54	13 17	13 46	14 01	14 18	14 38	15 04	15 39
	17	12 01	12 22	12 45	13 11	13 26	13 44	14 05	14 32	14 46	15 01	15 18	15 40	16 07
	18	12 57	13 16	13 36	13 58	14 11	14 26	14 45	15 07	15 18	15 30	15 44	16 00	16 19
	19	13 52	14 07	14 22	14 41	14 51	15 03	15 16	15 33	15 41	15 50	16 00	16 11	16 24
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	21	15 36	15 42	15 47	15 54	15 57	16 01	16 06	16 12	16 14	16 17	16 20	16 24	16 28
	22	16 27	16 27	16 27	16 28	16 28	16 28	16 28	16 28	16 28	16 28	16 28	16 28	16 28
	23	17 19	17 14	17 08	17 02	16 59	16 54	16 50	16 44	16 42	16 39	16 36	16 33	16 29
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	28	22 10	21 48	21 24	20 56	20 40	20 21	19 58	19 28	19 13	18 57	18 36	18 11	17 37
	29	23 08	22 47	22 24	21 57	21 42	21 23	21 01	20 33	20 19	20 04	19 45	19 21	18 51
	30	...	23 43	23 22	22 59	22 45	22 29	22 10	21 46	21 34	21 21	21 06	20 47	20 25
May	1	0 02	...	...	23 59	23 48	23 35	23 20	23 01	22 51	22 41	22 30	22 16	22 01
	2	0 51	0 35	0 19	...	...	...	...	...	...	...	23 52	23 42	23 32
	3	1 36	1 24	1 12	0 57	0 49	0 39	0 27	0 13	0 07	0 00	...	...	...
	4	2 18	2 11	2 02	1 52	1 47	1 40	1 33	1 24	1 20	1 15	1 10	1 04	0 58
	5	2 58	2 55	2 50	2 46	2 43	2 40	2 36	2 32	2 30	2 28	2 26	2 23	2 20
	6	3 37	3 38	3 38	3 38	3 39	3 39	3 39	3 39	3 40	3 40	3 40	3 40	3 41
	7	4 16	4 21	4 26	4 31	4 34	4 38	4 42	4 47	4 49	4 52	4 55	4 58	5 01
	8	4 57	5 05	5 14	5 25	5 31	5 38	5 46	5 56	6 00	6 05	6 11	6 17	6 24
	9	5 39	5 51	6 05	6 20	6 29	6 39	6 51	7 06	7 13	7 21	7 29	7 39	7 51
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	12	8 05	8 27	8 49	9 16	9 32	9 50	10 12	10 41	10 55	11 11	11 30	11 55	12 27
	13	9 00	9 22	9 46	10 14	10 30	10 49	11 12	11 42	11 57	12 14	12 35	13 01	13 36
	14	9 56	10 18	10 41	11 08	11 23	11 41	12 04	12 32	12 45	13 01	13 20	13 43	14 13
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	16	11 45	12 02	12 19	12 39	12 50	13 03	13 18	13 37	13 46	13 56	14 07	14 20	14 35
	17	12 37	12 49	13 02	13 17	13 25	13 35	13 46	13 59	14 05	14 12	14 20	14 28	14 38
	18	13 28	13 35	13 43	13 52	13 57	14 02	14 09	14 17	14 20	14 24	14 29	14 34	14 39

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
Date														
Apr.	1	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	2	11 52	12 14	12 38	13 06	13 22	13 41	14 04	14 33	14 48	15 04	15 24	15 49	16 23
	3	12 48	13 10	13 33	13 59	14 14	14 32	14 54	15 21	15 34	15 50	16 07	16 29	16 57
	4	13 41	14 01	14 21	14 45	14 58	15 14	15 32	15 56	16 07	16 19	16 34	16 51	17 11
	5	14 31	14 47	15 04	15 23	15 34	15 47	16 02	16 21	16 30	16 39	16 50	17 03	17 17
	6	15 16	15 28	15 42	15 56	16 05	16 15	16 26	16 40	16 46	16 53	17 01	17 10	17 20
	7	15 58	16 07	16 16	16 26	16 32	16 38	16 46	16 55	16 59	17 04	17 09	17 15	17 21
	8	16 39	16 43	16 48	16 53	16 56	16 59	17 03	17 08	17 10	17 12	17 15	17 18	17 21
	9	17 18	17 18	17 18	17 19	17 19	17 19	17 20	17 20	17 20	17 20	17 20	17 21	17 21
	10	17 57	17 53	17 49	17 44	17 42	17 39	17 36	17 32	17 30	17 28	17 26	17 23	17 20
	11	18 37	18 29	18 20	18 11	18 06	18 00	17 53	17 44	17 40	17 36	17 31	17 26	17 20
	12	19 18	19 07	18 54	18 40	18 32	18 23	18 12	17 59	17 53	17 46	17 39	17 30	17 21
	13	20 03	19 47	19 31	19 12	19 01	18 49	18 34	18 16	18 08	17 59	17 48	17 36	17 23
	14	20 50	20 32	20 12	19 49	19 36	19 20	19 02	18 40	18 29	18 17	18 03	17 47	17 27
	15	21 41	21 20	20 58	20 31	20 17	19 59	19 38	19 11	18 58	18 43	18 25	18 04	17 37
	16	22 35	22 13	21 49	21 21	21 05	20 46	20 23	19 54	19 39	19 22	19 02	18 37	18 03
	17	23 31	23 09	22 46	22 18	22 02	21 43	21 20	20 51	20 36	20 19	19 59	19 34	18 59
	18	0 28	0 08	23 46	23 21	23 06	22 49	22 28	22 02	21 49	21 34	21 17	20 56	20 29
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	21	3 09	3 01	2 53	2 43	2 37	2 31	2 23	2 14	2 09	2 05	1 59	1 54	1 47
	22	4 00	3 58	3 55	3 51	3 49	3 47	3 44	3 41	3 40	3 38	3 36	3 34	3 32
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	28	9 39	10 01	10 25	10 52	11 08	11 27	11 51	12 20	12 34	12 51	13 11	13 37	14 11
	29	10 38	11 00	11 24	11 51	12 07	12 25	12 48	13 16	13 30	13 46	14 05	14 29	15 00
	30	11 34	11 55	12 16	12 41	12 55	13 12	13 32	13 57	14 09	14 22	14 38	14 57	15 20
May	1	12 26	12 43	13 02	13 23	13 35	13 49	14 05	14 26	14 35	14 46	14 58	15 12	15 29
	2	13 13	13 27	13 42	13 58	14 08	14 19	14 31	14 47	14 54	15 02	15 11	15 21	15 32
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	16	23 56	23 41	23 23	23 13	23 01	22 47	22 29	22 21	22 12	22 01	21 49	21 35
	17	0 10	23 53	23 47	23 41	23 34	23 27	23 18
	18	1 01	0 52	0 41	0 29	0 22	0 14	0 04

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>	<small>h m</small>
May	17	12 37	12 49	13 02	13 17	13 25	13 35	13 46	13 59	14 05	14 12	14 20	14 28	14 38
	18	13 28	13 35	13 43	13 52	13 57	14 02	14 09	14 17	14 20	14 24	14 29	14 34	14 39
	19	14 17	14 19	14 22	14 25	14 26	14 28	14 30	14 33	14 34	14 35	14 37	14 38	14 40
	20	15 06	15 04	15 01	14 57	14 56	14 53	14 51	14 48	14 47	14 46	14 44	14 42	14 40
	21	15 58	15 50	15 41	15 32	15 26	15 20	15 13	15 05	15 01	14 57	14 52	14 47	14 41
	22	16 52	16 39	16 25	16 10	16 01	15 51	15 39	15 25	15 18	15 11	15 03	14 54	14 44
	23	17 49	17 32	17 14	16 53	16 41	16 27	16 10	15 50	15 41	15 30	15 18	15 04	14 48
	24	18 50	18 29	18 08	17 42	17 28	17 11	16 50	16 25	16 12	15 59	15 42	15 23	14 59
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	26	20 53	20 31	20 08	19 40	19 24	19 05	18 43	18 14	17 59	17 43	17 23	16 58	16 25
	27	21 51	21 30	21 09	20 44	20 29	20 12	19 52	19 26	19 13	18 59	18 42	18 21	17 55
	28	22 43	22 26	22 08	21 47	21 34	21 20	21 03	20 42	20 32	20 20	20 07	19 52	19 34
	29	23 31	23 18	23 03	22 47	22 37	22 26	22 13	21 58	21 50	21 42	21 32	21 21	21 09
	30	23 56	23 44	23 37	23 30	23 21	23 10	23 05	23 00	22 53	22 46	22 38
	31	0 15	0 06
June	1	0 56	0 51	0 45	0 39	0 35	0 31	0 26	0 20	0 17	0 14	0 11	0 07	0 03
	2	1 36	1 34	1 33	1 32	1 31	1 30	1 29	1 28	1 27	1 26	1 26	1 25	1 24
	3	2 15	2 17	2 21	2 24	2 26	2 29	2 32	2 35	2 36	2 38	2 40	2 42	2 45
	4	2 54	3 01	3 09	3 18	3 22	3 28	3 35	3 43	3 47	3 51	3 56	4 01	4 06
	5	3 36	3 47	3 59	4 12	4 20	4 29	4 40	4 53	4 59	5 06	5 13	5 22	5 31
	6	4 20	4 35	4 51	5 09	5 20	5 32	5 47	6 05	6 14	6 23	6 34	6 47	7 01
	7	5 08	5 26	5 46	6 08	6 21	6 37	6 55	7 18	7 29	7 42	7 57	8 14	8 35
	8	5 59	6 20	6 43	7 08	7 23	7 41	8 03	8 30	8 44	8 59	9 17	9 40	10 09
	9	6 54	7 16	7 40	8 08	8 24	8 43	9 06	9 35	9 50	10 07	10 27	10 53	11 28
	10	7 51	8 13	8 36	9 03	9 19	9 38	10 01	10 29	10 44	11 00	11 19	11 43	12 15
	11	8 47	9 07	9 29	9 54	10 08	10 25	10 45	11 11	11 23	11 37	11 53	12 12	12 36
	12	9 42	9 59	10 18	10 39	10 51	11 05	11 21	11 41	11 51	12 02	12 14	12 28	12 45
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	24	20 31	20 13	19 53	19 30	19 17	19 01	18 43	18 19	18 08	17 55	17 40	17 23	17 02
	25	21 22	21 07	20 51	20 33	20 22	20 10	19 55	19 37	19 28	19 19	19 08	18 56	18 41
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	30	0 11	0 13	0 14	0 16	0 17	0 18	0 20	0 21	0 22	0 23	0 24	0 25	0 26
July	1	0 51	0 56	1 02	1 09	1 13	1 17	1 23	1 29	1 32	1 35	1 39	1 43	1 47
	2	1 31	1 41	1 51	2 03	2 10	2 17	2 27	2 38	2 43	2 49	2 55	3 03	3 11

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May	17	0 10	...	...	...	...	...	...	23 53	23 47	23 41	23 34	23 27	23 18
	18	1 01	0 52	0 41	0 29	0 22	0 14	0 04	...	...	...	...	...	...
	19	1 51	1 46	1 41	1 34	1 31	1 27	1 22	1 16	1 14	1 11	1 08	1 04	1 00
	20	2 40	2 40	2 40	2 41	2 41	2 41	2 41	2 41	2 41	2 41	2 41	2 41	2 41
	21	3 30	3 36	3 41	3 48	3 52	3 56	4 01	4 07	4 10	4 13	4 16	4 20	4 24
	22	4 23	4 33	4 45	4 57	5 05	5 13	5 23	5 36	5 41	5 48	5 55	6 03	6 12
	23	5 19	5 34	5 50	6 09	6 20	6 33	6 48	7 06	7 15	7 25	7 36	7 49	8 05
	24	6 18	6 37	6 58	7 22	7 35	7 52	8 11	8 36	8 47	9 01	9 17	9 35	9 59
	25	7 20	7 41	8 05	8 32	8 47	9 06	9 28	9 57	10 11	10 27	10 46	11 10	11 42
	26	8 22	8 44	9 08	9 36	9 52	10 11	10 34	11 03	11 17	11 34	11 54	12 19	12 52
	27	9 21	9 42	10 05	10 31	10 46	11 04	11 25	11 52	12 05	12 19	12 37	12 58	13 24
	28	10 16	10 35	10 55	11 18	11 31	11 46	12 04	12 26	12 37	12 49	13 02	13 18	13 37
	29	11 07	11 22	11 38	11 56	12 07	12 19	12 33	12 51	12 59	13 08	13 18	13 29	13 42
	30	11 53	12 04	12 16	12 30	12 37	12 46	12 57	13 09	13 15	13 21	13 28	13 36	13 45
	31	12 35	12 42	12 50	12 59	13 04	13 09	13 16	13 24	13 27	13 31	13 35	13 40	13 46
June	1	13 15	13 18	13 22	13 26	13 28	13 30	13 33	13 36	13 38	13 39	13 41	13 43	13 46
	2	13 54	13 53	13 52	13 51	13 51	13 50	13 49	13 48	13 48	13 47	13 47	13 46	13 45
	3	14 33	14 28	14 23	14 17	14 14	14 10	14 05	14 00	13 58	13 55	13 52	13 49	13 45
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	6	16 43	16 26	16 08	15 48	15 37	15 23	15 08	14 48	14 39	14 29	14 17	14 04	13 49
	7	17 32	17 13	16 52	16 28	16 14	15 58	15 38	15 14	15 03	14 50	14 34	14 17	13 55
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	9	19 21	18 59	18 35	18 07	17 51	17 32	17 09	16 39	16 24	16 07	15 47	15 21	14 46
	10	20 18	19 57	19 33	19 07	18 51	18 33	18 11	17 42	17 28	17 12	16 53	16 29	15 57
	11	21 14	20 55	20 34	20 11	19 57	19 41	19 21	18 57	18 45	18 31	18 16	17 57	17 34
	12	22 07	21 52	21 35	21 16	21 05	20 52	20 37	20 18	20 09	19 59	19 47	19 33	19 18
	13	22 58	22 47	22 35	22 21	22 13	22 04	21 53	21 40	21 34	21 27	21 19	21 11	21 01
	14	23 47	23 41	23 34	23 26	23 21	23 16	23 10	23 03	22 59	22 55	22 51	22 46	22 41
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	16	0 35	0 34	0 32	0 30	0 29	0 28	0 26	0 24	0 24	0 23	0 22	0 21	0 19
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	19	3 06	3 19	3 34	3 50	3 59	4 10	4 23	4 39	4 47	4 55	5 04	5 15	5 27
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	21	5 02	5 23	5 45	6 11	6 25	6 43	7 04	7 31	7 44	8 00	8 17	8 39	9 07
	22	6 04	6 26	6 50	7 18	7 33	7 52	8 15	8 45	8 59	9 16	9 36	10 01	10 34
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	24	8 03	8 23	8 44	9 08	9 22	9 39	9 58	10 22	10 34	10 47	11 03	11 20	11 42
	25	8 56	9 13	9 31	9 51	10 03	10 16	10 32	10 51	11 01	11 11	11 22	11 35	11 51
	26	9 45	9 58	10 12	10 27	10 36	10 46	10 58	11 12	11 19	11 26	11 35	11 44	11 54
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	30	12 30	12 26	12 23	12 19	12 16	12 13	12 10	12 06	12 05	12 03	12 01	11 59	11 56
July	1	13 10	13 02	12 54	12 45	12 40	12 34	12 27	12 19	12 15	12 11	12 07	12 02	11 56
	2	13 52	13 40	13 28	13 14	13 06	12 57	12 46	12 33	12 27	12 21	12 14	12 06	11 57

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July	1	0 51	0 56	1 02	1 09	1 13	1 17	1 23	1 29	1 32	1 35	1 39	1 43	1 47
	2	1 31	1 41	1 51	2 03	2 10	2 17	2 27	2 38	2 43	2 49	2 55	3 03	3 11
	3	2 14	2 28	2 42	2 59	3 08	3 19	3 33	3 49	3 57	4 05	4 15	4 26	4 38
	4	3 00	3 18	3 36	3 57	4 09	4 23	4 41	5 02	5 12	5 23	5 37	5 52	6 11
	5	3 51	4 11	4 32	4 57	5 11	5 28	5 49	6 15	6 27	6 42	6 59	7 19	7 46
	6	4 45	5 06	5 30	5 57	6 13	6 32	6 55	7 23	7 38	7 55	8 14	8 39	9 13
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	8	6 39	7 00	7 23	7 49	8 04	8 21	8 42	9 09	9 22	9 37	9 54	10 15	10 41
	9	7 36	7 54	8 14	8 36	8 49	9 04	9 22	9 44	9 54	10 06	10 19	10 35	10 53
	10	8 30	8 45	9 00	9 18	9 28	9 39	9 53	10 09	10 17	10 25	10 35	10 46	10 58
	11	9 21	9 32	9 42	9 54	10 01	10 09	10 18	10 29	10 34	10 40	10 46	10 53	11 01
	12	10 11	10 16	10 22	10 28	10 31	10 35	10 40	10 46	10 48	10 51	10 54	10 58	11 02
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	15	12 36	12 26	12 16	12 05	11 59	11 51	11 43	11 33	11 28	11 23	11 17	11 11	11 04
	16	13 28	13 14	12 59	12 42	12 32	12 21	12 08	11 53	11 45	11 37	11 28	11 18	11 06
	17	14 23	14 05	13 46	13 24	13 11	12 57	12 40	12 18	12 08	11 57	11 44	11 29	11 12
	18	15 22	15 01	14 38	14 13	13 58	13 41	13 20	12 54	12 41	12 26	12 09	11 49	11 24
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	28	23 26	23 34	23 43	23 53	23 59
	29	0 06	0 13	0 23	0 27	0 32	0 37	0 43	0 50
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Aug.	31	0 53	1 08	1 25	1 45	1 56	2 09	2 25	2 44	2 54	3 04	3 16	3 29	3 46
	1	1 41	2 00	2 20	2 44	2 57	3 13	3 33	3 57	4 09	4 22	4 38	4 57	5 20
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	4	4 26	4 48	5 11	5 39	5 54	6 12	6 35	7 03	7 17	7 33	7 52	8 15	8 45
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	16	15 14	14 52	14 27	14 00	13 44	13 25	13 02	12 32	12 18	12 01	11 40	11 15	10 40
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date \ Lat.		Date													
		0°	−10°	−20°	−30°	−35°	−40°	−45°	−50°	−52°	−54°	−56°	−58°	−60°	
July	1	h m 13 10	h m 13 02	h m 12 54	h m 12 45	h m 12 40	h m 12 34	h m 12 27	h m 12 19	h m 12 15	h m 12 11	h m 12 07	h m 12 02	h m 11 56	
	2	13 52	13 40	13 28	13 14	13 06	12 57	12 46	12 33	12 27	12 21	12 14	12 06	11 57	
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	8	19 07	18 47	18 25	18 01	17 46	17 29	17 08	16 42	16 30	16 15	15 58	15 38	15 12	
	9	20 02	19 45	19 27	19 07	18 55	18 41	18 24	18 03	17 53	17 42	17 29	17 14	16 57	
	10	20 55	20 42	20 29	20 14	20 05	19 54	19 42	19 27	19 20	19 12	19 04	18 54	18 42	
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	13	23 21	23 23	23 26	23 28	23 29	23 31	23 33	23 35	23 36	23 38	23 39	23 40	23 42	
	14	
	15	0 10	0 17	0 24	0 33	0 38	0 44	0 50	0 58	1 02	1 06	1 11	1 16	1 22	
	16	1 00	1 12	1 25	1 40	1 48	1 58	2 09	2 23	2 29	2 37	2 45	2 54	3 05	
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	19	3 51	4 13	4 36	5 03	5 19	5 38	6 00	6 29	6 43	7 00	7 19	7 44	8 16	
	20	4 51	5 13	5 37	6 05	6 21	6 40	7 02	7 31	7 46	8 02	8 22	8 46	9 19	
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Aug.	31	13 15	12 58	12 39	12 18	12 06	11 52	11 35	11 15	11 05	10 54	10 41	10 27	10 10	
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16	2 43	3 05	3 30	3 57	4 13	4 32	4 56	5 25	5 40	5 57	6 17	6 43	7 17		
17	3 42	4 03	4 26	4 53	5 08	5 26	5 48	6 16	6 29	6 45	7 03	7 25	7 54		

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date \ Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	15 14	14 52	14 27	14 00	13 44	13 25	13 02	12 32	12 18	12 01	11 40	11 15	10 40
	17	16 11	15 50	15 28	15 02	14 47	14 30	14 08	13 41	13 28	13 13	12 55	12 33	12 05
	18	17 05	16 47	16 28	16 06	15 53	15 38	15 20	14 57	14 47	14 34	14 20	14 04	13 44
	19	17 54	17 40	17 25	17 07	16 57	16 46	16 32	16 15	16 07	15 58	15 47	15 36	15 22
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	21	19 23	19 17	19 10	19 03	18 59	18 54	18 49	18 42	18 39	18 36	18 32	18 28	18 23
	22	20 03	20 01	20 00	19 58	19 57	19 55	19 54	19 52	19 51	19 50	19 49	19 48	19 47
	23	20 43	20 45	20 48	20 51	20 53	20 55	20 58	21 01	21 02	21 03	21 05	21 07	21 09
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	25	22 03	22 14	22 26	22 39	22 46	22 55	23 05	23 18	23 24	23 30	23 37	23 46	23 55
	26	22 46	23 01	23 16	23 35	23 45	23 57	0 11	0 29	0 37	0 46	0 57	1 09	1 23
	27	23 32	23 50	0 00	0 32	0 45	1 00	1 18	1 40	1 51	2 04	2 18	2 35	2 55
	28	0 22	0 43	1 05	1 31	1 45	2 03	2 24	2 51	3 05	3 20	3 38	4 00	4 29
	29	1 15	1 38	2 01	2 29	2 45	3 04	3 28	3 58	4 12	4 29	4 50	5 16	5 53
	30	2 11	2 34	2 58	3 26	3 42	4 01	4 24	4 54	5 08	5 25	5 46	6 11	6 46
Sept.	1	3 09	3 30	3 52	4 18	4 33	4 50	5 11	5 38	5 51	6 06	6 23	6 43	7 09
	2	4 06	4 24	4 43	5 05	5 17	5 32	5 50	6 11	6 21	6 33	6 46	7 01	7 19
	3	5 01	5 15	5 30	5 47	5 56	6 07	6 20	6 36	6 43	6 51	7 00	7 11	7 22
	4	5 54	6 03	6 13	6 24	6 30	6 37	6 46	6 56	7 00	7 05	7 11	7 17	7 24
	5	6 45	6 49	6 53	6 58	7 01	7 04	7 08	7 12	7 14	7 16	7 19	7 21	7 24
	6	7 35	7 34	7 33	7 32	7 31	7 30	7 29	7 28	7 27	7 26	7 26	7 25	7 24
	7	8 26	8 20	8 13	8 05	8 01	7 56	7 50	7 44	7 40	7 37	7 33	7 29	7 25
	8	9 18	9 07	8 55	8 41	8 33	8 24	8 14	8 01	7 56	7 49	7 42	7 34	7 26
	9	10 13	9 57	9 40	9 20	9 09	8 57	8 42	8 23	8 15	8 05	7 55	7 42	7 28
	10	11 10	10 51	10 29	10 06	9 52	9 35	9 16	8 52	8 41	8 28	8 13	7 56	7 34
	11	12 09	11 47	11 24	10 57	10 41	10 22	10 00	9 32	9 18	9 02	8 43	8 20	7 50
	12	13 09	12 46	12 22	11 54	11 37	11 18	10 55	10 25	10 10	9 53	9 32	9 06	8 30
	13	14 06	13 45	13 22	12 55	12 39	12 21	11 59	11 30	11 16	11 01	10 41	10 17	9 46
	14	15 01	14 41	14 21	13 58	13 44	13 28	13 09	12 44	12 33	12 19	12 04	11 46	11 23
	15	15 51	15 35	15 18	14 59	14 48	14 35	14 20	14 01	13 52	13 42	13 30	13 17	13 02
	16	16 37	16 25	16 13	15 59	15 50	15 41	15 30	15 16	15 10	15 03	14 55	14 46	14 36
	17	17 20	17 13	17 05	16 56	16 50	16 44	16 37	16 29	16 25	16 21	16 16	16 11	16 05
	18	18 01	17 58	17 54	17 50	17 48	17 46	17 43	17 39	17 38	17 36	17 34	17 32	17 29
	19	18 40	18 42	18 43	18 44	18 45	18 46	18 47	18 48	18 49	18 49	18 50	18 51	18 52
	20	19 20	19 25	19 31	19 37	19 41	19 45	19 50	19 56	19 59	20 02	20 06	20 09	20 14
	21	20 00	20 10	20 20	20 31	20 38	20 45	20 54	21 05	21 10	21 16	21 22	21 29	21 37
	22	20 42	20 56	21 10	21 26	21 36	21 47	22 00	22 15	22 23	22 31	22 41	22 52	23 04
	23	21 27	21 44	22 02	22 23	22 35	22 49	23 06	23 27	23 37	23 48	0 01	0 16	0 34
	24	22 15	22 34	22 56	23 21	23 35	23 52	0 12	0 38	0 50	1 05	1 22	1 42	2 08
	25	23 06	23 28	23 51	0 19	0 34	0 53	1 16	1 45	2 00	2 17	2 37	3 02	3 37
	26	0 00	0 22	0 46	1 15	1 31	1 51	2 14	2 45	3 00	3 17	3 39	4 06	4 44
	27	0 55	1 17	1 40	2 08	2 23	2 42	3 04	3 33	3 47	4 03	4 22	4 45	5 16
	28	1 51	2 10	2 32	2 56	3 09	3 26	3 45	4 09	4 21	4 34	4 49	5 07	5 29
Oct.	29	2 46	3 02	3 19	3 39	3 50	4 03	4 18	4 37	4 46	4 56	5 06	5 19	5 34
	1	3 39	3 51	4 03	4 17	4 25	4 34	4 45	4 58	5 04	5 11	5 18	5 26	5 36
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LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug.	16	2 43	3 05	3 30	3 57	4 13	4 32	4 56	5 25	5 40	5 57	6 17	6 43	7 17
	17	3 42	4 03	4 26	4 53	5 08	5 26	5 48	6 16	6 29	6 45	7 03	7 25	7 54
	18	4 37	4 57	5 17	5 41	5 54	6 10	6 29	6 52	7 04	7 16	7 31	7 48	8 08
	19	5 29	5 45	6 02	6 22	6 32	6 45	7 00	7 19	7 27	7 37	7 48	8 00	8 14
	20	6 17	6 29	6 42	6 56	7 04	7 14	7 25	7 38	7 44	7 51	7 59	8 07	8 17
	21	7 01	7 09	7 17	7 27	7 32	7 38	7 45	7 54	7 58	8 02	8 07	8 12	8 18
	22	7 42	7 46	7 50	7 54	7 57	8 00	8 03	8 07	8 09	8 11	8 13	8 15	8 18
	23	8 22	8 22	8 21	8 21	8 20	8 20	8 19	8 19	8 18	8 18	8 18	8 17	8 17
	24	9 02	8 57	8 52	8 46	8 43	8 40	8 36	8 31	8 28	8 26	8 23	8 20	8 17
	25	9 42	9 33	9 24	9 13	9 07	9 01	8 53	8 43	8 39	8 34	8 29	8 23	8 16
	26	10 24	10 11	9 58	9 42	9 34	9 24	9 12	8 58	8 51	8 44	8 36	8 27	8 17
	27	11 08	10 52	10 34	10 15	10 03	9 50	9 35	9 16	9 07	8 57	8 46	8 33	8 18
	28	11 56	11 36	11 16	10 52	10 38	10 23	10 04	9 40	9 29	9 16	9 01	8 44	8 23
	29	12 47	12 26	12 03	11 36	11 21	11 02	10 40	10 13	9 59	9 44	9 25	9 03	8 34
	30	13 42	13 19	12 55	12 27	12 11	11 52	11 28	10 58	10 43	10 26	10 05	9 39	9 02
Sept.	31	14 39	14 17	13 53	13 26	13 10	12 51	12 28	11 59	11 44	11 27	11 07	10 42	10 07
	1	15 36	15 16	14 55	14 30	14 16	13 59	13 39	13 13	13 01	12 46	12 29	12 09	11 44
	2	16 32	16 16	15 59	15 38	15 27	15 13	14 57	14 37	14 27	14 16	14 04	13 49	13 32
	3	17 26	17 14	17 02	16 47	16 39	16 29	16 18	16 04	15 57	15 50	15 42	15 32	15 22
	4	18 18	18 12	18 04	17 56	17 51	17 46	17 39	17 31	17 28	17 24	17 19	17 14	17 09
	5	19 09	19 07	19 06	19 04	19 03	19 02	19 00	18 59	18 58	18 57	18 56	18 55	18 54
	6	19 59	20 03	20 07	20 12	20 15	20 18	20 21	20 25	20 27	20 30	20 32	20 35	20 38
	7	20 51	21 00	21 09	21 21	21 27	21 34	21 43	21 53	21 58	22 03	22 09	22 16	22 24
	8	21 44	21 58	22 13	22 30	22 40	22 51	23 05	23 21	23 29	23 38	23 48	...	...
	9	22 40	22 58	23 18	23 40	23 53	...	...	...	...	...	...	0 00	0 13
	10	23 38	23 59	...	...	...	0 08	0 26	0 49	1 00	1 12	1 27	1 43	2 04
	11	...	...	0 22	0 48	1 03	1 21	1 43	2 11	2 24	2 40	2 59	3 21	3 51
	12	0 38	1 00	1 25	1 52	2 09	2 28	2 51	3 21	3 36	3 53	4 14	4 40	5 16
	13	1 37	1 59	2 23	2 50	3 06	3 25	3 47	4 16	4 30	4 47	5 06	5 30	6 02
	14	2 33	2 53	3 15	3 40	3 54	4 11	4 31	4 56	5 08	5 22	5 37	5 56	6 19
	15	3 25	3 42	4 01	4 22	4 34	4 48	5 04	5 24	5 34	5 44	5 57	6 10	6 27
	16	4 13	4 27	4 41	4 57	5 07	5 17	5 30	5 45	5 52	6 00	6 08	6 18	6 29
	17	4 58	5 07	5 18	5 29	5 35	5 42	5 51	6 01	6 06	6 11	6 17	6 23	6 30
	18	5 40	5 45	5 51	5 57	6 00	6 04	6 09	6 15	6 17	6 20	6 23	6 26	6 30
	19	6 20	6 21	6 22	6 23	6 24	6 25	6 25	6 26	6 27	6 27	6 28	6 29	6 29
	20	6 59	6 56	6 53	6 49	6 47	6 44	6 41	6 38	6 36	6 35	6 33	6 31	6 28
	21	7 39	7 32	7 24	7 15	7 10	7 05	6 58	6 50	6 46	6 43	6 38	6 33	6 28
	22	8 20	8 09	7 57	7 43	7 35	7 27	7 16	7 04	6 58	6 52	6 44	6 36	6 27
	23	9 03	8 48	8 32	8 14	8 04	7 52	7 37	7 20	7 12	7 03	6 53	6 41	6 28
	24	9 50	9 31	9 12	8 49	8 36	8 21	8 03	7 41	7 31	7 19	7 05	6 50	6 31
	25	10 39	10 18	9 56	9 29	9 15	8 57	8 36	8 10	7 57	7 42	7 25	7 04	6 38
	26	11 31	11 09	10 45	10 17	10 01	9 42	9 18	8 49	8 34	8 17	7 57	7 31	6 56
	27	12 26	12 04	11 39	11 11	10 55	10 35	10 12	9 41	9 26	9 09	8 48	8 21	7 42
	28	13 22	13 01	12 38	12 12	11 57	11 38	11 16	10 49	10 35	10 19	10 00	9 37	9 06
	29	14 17	13 59	13 39	13 17	13 04	12 48	12 30	12 07	11 56	11 43	11 28	11 11	10 50
Oct.	30	15 11	14 57	14 42	14 24	14 14	14 02	13 48	13 31	13 23	13 14	13 03	12 52	12 38
	1	16 03	15 54	15 44	15 32	15 26	15 18	15 09	14 58	14 53	14 47	14 41	14 33	14 25
	2	16 55	16 50	16 46	16 41	16 38	16 34	16 30	16 25	16 23	16 20	16 18	16 15	16 11

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
 MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	3 39	3 51	4 03	4 17	4 25	4 34	4 45	4 58	5 04	5 11	5 18	5 26	5 36
	2	4 30	4 37	4 44	4 53	4 57	5 02	5 08	5 16	5 19	5 23	5 27	5 31	5 36
	3	5 21	5 23	5 25	5 26	5 27	5 29	5 30	5 32	5 32	5 33	5 34	5 35	5 36
	4	6 13	6 09	6 05	6 00	5 58	5 55	5 51	5 47	5 45	5 43	5 41	5 39	5 36
	5	7 06	6 56	6 47	6 36	6 29	6 22	6 14	6 04	6 00	5 55	5 49	5 43	5 36
	6	8 01	7 47	7 32	7 15	7 05	6 54	6 41	6 25	6 17	6 09	6 00	5 50	5 38
	7	8 59	8 41	8 21	7 59	7 46	7 31	7 13	6 51	6 41	6 29	6 16	6 01	5 42
	8	10 00	9 39	9 16	8 49	8 34	8 16	7 55	7 27	7 14	6 59	6 41	6 20	5 53
	9	11 01	10 39	10 14	9 46	9 30	9 10	8 47	8 17	8 02	7 45	7 24	6 58	6 22
	10	12 01	11 39	11 15	10 47	10 31	10 13	9 50	9 20	9 06	8 49	8 28	8 03	7 28
	11	12 57	12 37	12 16	11 51	11 36	11 19	10 59	10 33	10 20	10 06	9 49	9 29	9 03
	12	13 48	13 32	13 14	12 53	12 41	12 27	12 10	11 50	11 40	11 28	11 16	11 01	10 43
	13	14 36	14 23	14 09	13 53	13 44	13 33	13 21	13 05	12 58	12 50	12 41	12 31	12 19
	14	15 19	15 10	15 01	14 50	14 44	14 37	14 28	14 18	14 14	14 09	14 03	13 56	13 49
	15	16 00	15 56	15 51	15 45	15 42	15 38	15 34	15 29	15 26	15 24	15 21	15 18	15 14
	16	16 40	16 39	16 39	16 39	16 38	16 38	16 38	16 38	16 37	16 37	16 37	16 37	16 37
	17	17 19	17 23	17 27	17 32	17 35	17 38	17 41	17 46	17 48	17 50	17 53	17 55	17 59
	18	17 59	18 07	18 16	18 26	18 31	18 37	18 45	18 54	18 59	19 03	19 09	19 15	19 21
	19	18 40	18 52	19 05	19 20	19 28	19 38	19 50	20 04	20 11	20 18	20 27	20 36	20 47
	20	19 24	19 40	19 57	20 16	20 27	20 40	20 56	21 15	21 25	21 35	21 47	22 00	22 16
	21	20 11	20 30	20 50	21 14	21 27	21 43	22 03	22 27	22 39	22 52	23 08	23 26	23 49
	22	21 00	21 22	21 45	22 11	22 27	22 45	23 07	23 36	23 50	...	...	...	...
	23	21 53	22 15	22 40	23 08	23 24	23 43	...	...	...	0 06	0 25	0 49	1 21
	24	22 47	23 09	23 33	...	...	...	0 07	0 37	0 53	1 10	1 32	1 59	2 38
	25	23 41	...	...	0 01	0 17	0 36	0 59	1 29	1 43	2 01	2 21	2 46	3 21
	26	...	0 02	0 24	0 49	1 04	1 21	1 42	2 08	2 21	2 36	2 53	3 13	3 38
	27	0 34	0 52	1 11	1 33	1 45	2 00	2 17	2 38	2 48	3 00	3 12	3 27	3 45
	28	1 26	1 40	1 55	2 12	2 21	2 32	2 45	3 01	3 08	3 16	3 25	3 36	3 47
	29	2 17	2 26	2 36	2 47	2 54	3 01	3 09	3 19	3 24	3 29	3 35	3 41	3 48
	30	3 07	3 11	3 16	3 21	3 24	3 27	3 31	3 35	3 37	3 40	3 42	3 45	3 48
Nov.	31	3 57	3 56	3 55	3 54	3 53	3 52	3 51	3 51	3 50	3 50	3 49	3 49	3 48
	1	4 48	4 42	4 35	4 28	4 23	4 19	4 13	4 06	4 03	4 00	3 57	3 52	3 48
	2	5 43	5 31	5 19	5 05	4 57	4 48	4 37	4 25	4 19	4 13	4 06	3 58	3 49
	3	6 41	6 24	6 07	5 47	5 36	5 23	5 07	4 48	4 40	4 30	4 19	4 06	3 52
	4	7 43	7 22	7 01	6 36	6 22	6 05	5 45	5 20	5 08	4 55	4 39	4 21	3 59
	5	8 46	8 24	8 00	7 32	7 16	6 57	6 34	6 05	5 51	5 34	5 14	4 50	4 18
	6	9 49	9 27	9 03	8 34	8 18	7 59	7 35	7 05	6 50	6 32	6 11	5 45	5 08
	7	10 49	10 28	10 05	9 39	9 24	9 06	8 45	8 17	8 04	7 48	7 30	7 07	6 38
	8	11 43	11 25	11 06	10 44	10 31	10 16	9 58	9 35	9 24	9 12	8 58	8 41	8 21
	9	12 33	12 19	12 03	11 46	11 36	11 24	11 10	10 53	10 45	10 36	10 25	10 14	10 00
	10	13 18	13 08	12 57	12 44	12 37	12 29	12 19	12 08	12 02	11 56	11 49	11 42	11 33
	11	14 00	13 54	13 47	13 40	13 36	13 31	13 26	13 19	13 16	13 12	13 09	13 05	13 00
	12	14 40	14 38	14 36	14 34	14 33	14 31	14 30	14 28	14 27	14 26	14 25	14 24	14 23
	13	15 19	15 21	15 24	15 27	15 29	15 31	15 33	15 36	15 37	15 39	15 40	15 42	15 44
	14	15 58	16 05	16 12	16 20	16 25	16 30	16 36	16 44	16 48	16 52	16 56	17 01	17 06
	15	16 39	16 50	17 01	17 14	17 22	17 30	17 41	17 53	17 59	18 06	18 13	18 21	18 30
	16	17 22	17 36	17 52	18 10	18 20	18 32	18 47	19 04	19 13	19 22	19 32	19 45	19 59
	17	18 08	18 26	18 45	19 07	19 20	19 35	19 53	20 16	20 27	20 39	20 54	21 11	21 31

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct.	1	16 03	15 54	15 44	15 32	15 26	15 18	15 09	14 58	14 53	14 47	14 41	14 33	14 25
	2	16 55	16 50	16 46	16 41	16 38	16 34	16 30	16 25	16 23	16 20	16 18	16 15	16 11
	3	17 46	17 47	17 48	17 49	17 50	17 51	17 52	17 53	17 54	17 55	17 55	17 56	17 57
	4	18 38	18 44	18 51	18 59	19 04	19 09	19 15	19 23	19 26	19 30	19 34	19 39	19 45
	5	19 32	19 43	19 56	20 11	20 19	20 29	20 40	20 54	21 01	21 08	21 16	21 25	21 36
	6	20 28	20 45	21 03	21 24	21 35	21 49	22 06	22 26	22 36	22 47	23 00	23 14	23 32
	7	21 28	21 48	22 10	22 36	22 50	23 07	23 28	23 54	...	...	...	...	...
	8	22 30	22 52	23 16	23 44	...	...	...	...	0 07	0 22	0 39	1 00	1 26
	9	23 30	23 53	...	...	0 00	0 19	0 42	1 12	1 27	1 44	2 05	2 30	3 06
	10	...	...	0 17	0 45	1 01	1 21	1 44	2 14	2 28	2 45	3 06	3 31	4 06
	11	0 28	0 49	1 12	1 38	1 53	2 11	2 32	2 58	3 11	3 26	3 43	4 04	4 30
	12	1 22	1 41	2 00	2 23	2 35	2 50	3 08	3 30	3 40	3 52	4 05	4 20	4 39
	13	2 12	2 26	2 42	3 00	3 10	3 22	3 36	3 52	4 00	4 09	4 19	4 30	4 42
	14	2 57	3 08	3 19	3 32	3 39	3 48	3 58	4 09	4 15	4 21	4 27	4 35	4 43
	15	3 39	3 46	3 53	4 01	4 05	4 10	4 16	4 23	4 26	4 30	4 34	4 38	4 43
	16	4 19	4 22	4 24	4 27	4 29	4 31	4 33	4 35	4 36	4 38	4 39	4 41	4 42
	17	4 59	4 57	4 55	4 53	4 52	4 50	4 49	4 47	4 46	4 45	4 44	4 43	4 41
	18	5 38	5 32	5 26	5 19	5 15	5 10	5 05	4 58	4 56	4 52	4 49	4 45	4 40
	19	6 19	6 09	5 58	5 46	5 39	5 31	5 22	5 11	5 06	5 01	4 55	4 48	4 40
	20	7 01	6 47	6 32	6 16	6 06	5 55	5 42	5 26	5 19	5 11	5 02	4 52	4 40
	21	7 46	7 29	7 10	6 49	6 37	6 23	6 06	5 46	5 36	5 25	5 13	4 59	4 42
	22	8 34	8 14	7 53	7 27	7 13	6 56	6 36	6 11	5 59	5 45	5 29	5 10	4 46
	23	9 25	9 03	8 39	8 12	7 56	7 37	7 15	6 46	6 32	6 15	5 56	5 31	4 59
	24	10 19	9 56	9 31	9 03	8 47	8 27	8 03	7 33	7 18	7 00	6 39	6 11	5 32
	25	11 13	10 51	10 27	10 01	9 44	9 25	9 03	8 33	8 19	8 02	7 42	7 17	6 42
	26	12 07	11 47	11 26	11 02	10 48	10 31	10 11	9 46	9 33	9 19	9 03	8 43	8 18
	27	12 59	12 43	12 26	12 06	11 55	11 41	11 25	11 05	10 56	10 45	10 33	10 18	10 02
	28	13 51	13 39	13 26	13 12	13 03	12 54	12 42	12 28	12 21	12 14	12 06	11 57	11 46
	29	14 41	14 34	14 26	14 18	14 13	14 07	14 01	13 53	13 49	13 45	13 40	13 35	13 29
	30	15 30	15 29	15 27	15 25	15 23	15 22	15 20	15 18	15 17	15 16	15 15	15 14	15 12
Nov.	31	16 21	16 25	16 28	16 33	16 35	16 38	16 42	16 46	16 48	16 50	16 52	16 55	16 58
	1	17 14	17 23	17 33	17 44	17 50	17 57	18 06	18 16	18 21	18 27	18 33	18 39	18 47
	2	18 10	18 24	18 39	18 57	19 07	19 19	19 33	19 50	19 58	20 07	20 17	20 29	20 42
	3	19 10	19 29	19 48	20 12	20 25	20 41	21 00	21 23	21 34	21 47	22 03	22 20	22 42
	4	20 13	20 35	20 58	21 25	21 40	21 59	22 21	22 50	23 04	23 20	23 40	...	...
	5	21 17	21 39	22 04	22 32	22 48	23 08	23 31	...	...	...	...	0 04	0 36
	6	22 18	22 40	23 03	23 31	23 46	...	...	0 02	0 17	0 34	0 55	1 21	1 58
	7	23 16	23 35	23 56	...	...	0 05	0 27	0 55	1 09	1 24	1 43	2 06	2 36
	8	0 20	0 33	0 49	1 08	1 32	1 43	1 56	2 11	2 28	2 49
	9	0 08	0 24	0 41	1 00	1 11	1 24	1 39	1 58	2 06	2 16	2 27	2 39	2 54
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	11	1 38	1 46	1 55	2 04	2 10	2 16	2 23	2 31	2 35	2 40	2 44	2 50	2 56
	12	2 19	2 23	2 27	2 31	2 34	2 37	2 40	2 44	2 46	2 48	2 50	2 52	2 55
	13	2 58	2 58	2 58	2 57	2 57	2 56	2 56	2 56	2 55	2 55	2 55	2 55	2 54
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	15	4 18	4 09	4 00	3 49	3 43	3 37	3 29	3 19	3 15	3 10	3 05	2 59	2 53
	16	4 59	4 47	4 33	4 18	4 09	3 59	3 48	3 34	3 27	3 20	3 12	3 03	2 53
	17	5 44	5 27	5 10	4 50	4 39	4 26	4 10	3 52	3 43	3 33	3 21	3 09	2 54

LOCAL MEAN TIME OF MOONRISE (UPPER LIMB)
MERIDIAN OF GREENWICH

Date	Lat.	0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
		h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov.	16	17 22	17 36	17 52	18 10	18 20	18 32	18 47	19 04	19 13	19 22	19 32	19 45	19 59
	17	18 08	18 26	18 45	19 07	19 20	19 35	19 53	20 16	20 27	20 39	20 54	21 11	21 31
	18	18 57	19 17	19 40	20 05	20 20	20 38	20 59	21 26	21 40	21 55	22 13	22 35	23 04
	19	19 49	20 11	20 35	21 02	21 19	21 38	22 01	22 31	22 46	23 03	23 24	23 51	.. ..
	20	20 42	21 05	21 29	21 57	22 13	22 32	22 56	23 26	23 41	23 58	.. ..	.. ..	0 28
	21	21 36	21 57	22 20	22 47	23 02	23 20	23 41	.. ..	.. ..	.. ..	0 19	0 45	1 22
	22	22 29	22 48	23 08	23 31	23 44	.. ..	.. ..	0 09	0 22	0 37	0 55	1 17	1 45
	23	23 20	23 36	23 52	.. ..	.. ..	0 00	0 18	0 41	0 52	1 04	1 18	1 34	1 54
	24	.. ..	.. ..	.. ..	0 10	0 21	0 33	0 48	1 05	1 13	1 22	1 33	1 44	1 58
	25	0 09	0 21	0 32	0 46	0 53	1 02	1 12	1 24	1 30	1 36	1 43	1 50	1 59
	26	0 58	1 04	1 11	1 18	1 23	1 28	1 33	1 40	1 43	1 47	1 51	1 55	1 59
	27	1 45	1 47	1 48	1 50	1 51	1 52	1 53	1 55	1 56	1 56	1 57	1 58	1 59
	28	2 34	2 30	2 26	2 22	2 20	2 17	2 13	2 10	2 08	2 06	2 04	2 02	1 59
	29	3 25	3 16	3 07	2 57	2 50	2 44	2 36	2 26	2 22	2 17	2 12	2 06	2 00
	30	4 21	4 07	3 52	3 35	3 26	3 15	3 02	2 47	2 39	2 31	2 22	2 13	2 01
Dec.	1	5 20	5 02	4 42	4 20	4 07	3 53	3 35	3 13	3 03	2 52	2 39	2 24	2 06
	2	6 24	6 02	5 39	5 13	4 58	4 40	4 18	3 51	3 38	3 23	3 06	2 45	2 18
	3	7 29	7 06	6 42	6 14	5 57	5 38	5 14	4 45	4 30	4 12	3 52	3 26	2 51
	4	8 32	8 11	7 47	7 20	7 04	6 45	6 22	5 54	5 39	5 22	5 03	4 38	4 05
	5	9 31	9 12	8 51	8 27	8 13	7 57	7 37	7 12	7 00	6 47	6 31	6 11	5 48
	6	10 25	10 09	9 52	9 32	9 21	9 08	8 53	8 33	8 24	8 14	8 02	7 49	7 33
	7	11 13	11 01	10 49	10 34	10 26	10 16	10 05	9 52	9 45	9 38	9 30	9 21	9 11
	8	11 57	11 49	11 41	11 32	11 27	11 21	11 14	11 06	11 02	10 58	10 53	10 47	10 41
	9	12 38	12 35	12 31	12 27	12 25	12 23	12 20	12 16	12 15	12 13	12 11	12 09	12 06
	10	13 17	13 18	13 19	13 21	13 22	13 22	13 24	13 25	13 25	13 26	13 27	13 28	13 29
	11	13 56	14 02	14 07	14 14	14 18	14 22	14 27	14 33	14 36	14 39	14 42	14 46	14 50
	12	14 37	14 46	14 56	15 08	15 14	15 22	15 31	15 42	15 47	15 52	15 59	16 05	16 13
	13	15 19	15 32	15 46	16 03	16 12	16 23	16 36	16 52	16 59	17 08	17 17	17 28	17 40
	14	16 04	16 21	16 39	16 59	17 11	17 26	17 43	18 04	18 14	18 25	18 38	18 53	19 11
	15	16 52	17 12	17 33	17 57	18 12	18 29	18 49	19 15	19 27	19 42	19 59	20 19	20 45
	16	17 43	18 05	18 29	18 56	19 12	19 30	19 53	20 22	20 37	20 54	21 14	21 39	22 13
	17	18 37	18 59	19 24	19 52	20 08	20 27	20 51	21 21	21 36	21 54	22 14	22 41	23 18
	18	19 32	19 53	20 17	20 44	20 59	21 18	21 40	22 08	22 22	22 38	22 57	23 20	23 50
	19	20 25	20 45	21 06	21 30	21 44	22 00	22 19	22 43	22 55	23 08	23 23	23 41	.. ..
	20	21 17	21 34	21 51	22 11	22 22	22 35	22 51	23 10	23 19	23 28	23 40	23 53	0 03
	21	22 07	22 19	22 32	22 47	22 55	23 05	23 16	23 30	23 36	23 43	23 51	.. ..	0 08
	22	22 54	23 02	23 10	23 20	23 25	23 31	23 38	23 46	23 50	23 55	23 59	0 00	0 09
	23	23 41	23 44	23 47	23 51	23 53	23 55	23 58	.. ..	.. ..	.. ..	.. ..	0 04	0 10
	24	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 02	0 04	0 06	0 08	0 10
	25	0 28	0 26	0 24	0 21	0 20	0 19	0 17	0 15	0 14	0 13	0 12	0 11	0 10
	26	1 16	1 09	1 02	0 53	0 49	0 44	0 37	0 30	0 27	0 23	0 19	0 15	0 10
	27	2 07	1 55	1 43	1 29	1 21	1 11	1 01	0 48	0 42	0 35	0 28	0 20	0 11
	28	3 03	2 46	2 29	2 09	1 58	1 45	1 29	1 11	1 02	0 52	0 41	0 28	0 14
	29	4 03	3 43	3 21	2 57	2 43	2 26	2 07	1 42	1 30	1 17	1 02	0 43	0 21
	30	5 07	4 44	4 20	3 53	3 37	3 18	2 56	2 27	2 12	1 56	1 37	1 13	0 41
	31	6 11	5 49	5 25	4 57	4 40	4 21	3 58	3 28	3 13	2 56	2 35	2 09	1 33
	32	7 13	6 53	6 30	6 05	5 50	5 32	5 10	4 43	4 30	4 15	3 57	3 35	3 07

LOCAL MEAN TIME OF MOONSET (UPPER LIMB)
MERIDIAN OF GREENWICH

Lat.		0°	-10°	-20°	-30°	-35°	-40°	-45°	-50°	-52°	-54°	-56°	-58°	-60°
Date														
Nov.	16	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
	17	4 59	4 47	4 33	4 18	4 09	3 59	3 48	3 34	3 27	3 20	3 12	3 03	2 53
	18	5 44	5 27	5 10	4 50	4 39	4 26	4 10	3 52	3 43	3 33	3 21	3 09	2 54
	19	6 31	6 12	5 51	5 27	5 14	4 58	4 39	4 15	4 04	3 51	3 36	3 18	2 58
	20	7 21	7 00	6 37	6 10	5 55	5 36	5 14	4 47	4 33	4 17	3 59	3 36	3 07
	21	8 14	7 52	7 27	7 00	6 43	6 23	6 00	5 30	5 15	4 58	4 36	4 10	3 33
	22	9 08	8 46	8 22	7 55	7 38	7 19	6 56	6 26	6 11	5 54	5 33	5 07	4 31
	23	10 02	9 41	9 19	8 54	8 39	8 22	8 01	7 34	7 21	7 06	6 49	6 27	6 00
	24	10 54	10 36	10 18	9 57	9 44	9 29	9 12	8 50	8 40	8 28	8 14	7 59	7 40
	25	11 44	11 31	11 16	11 00	10 50	10 39	10 26	10 10	10 02	9 54	9 44	9 33	9 21
	26	12 32	12 24	12 14	12 03	11 57	11 50	11 41	11 31	11 26	11 21	11 15	11 08	11 01
	27	13 20	13 16	13 12	13 07	13 04	13 01	12 57	12 53	12 50	12 48	12 45	12 43	12 39
	28	14 08	14 09	14 10	14 12	14 13	14 13	14 14	14 16	14 16	14 17	14 17	14 18	14 19
	29	15 51	16 02	16 15	16 29	16 37	16 47	16 58	17 11	17 17	17 24	17 32	17 41	17 52
	30	16 48	17 05	17 22	17 43	17 54	18 08	18 24	18 44	18 54	19 04	19 17	19 31	19 48
Dec.	1	17 50	18 10	18 32	18 57	19 11	19 29	19 49	20 15	20 28	20 43	21 00	21 21	21 47
	2	18 55	19 17	19 41	20 09	20 25	20 44	21 08	21 37	21 52	22 09	22 30	22 55	23 31
	3	20 00	20 22	20 46	21 14	21 30	21 49	22 12	22 42	22 56	23 13	23 33	23 58	...
	4	21 01	21 22	21 44	22 09	22 24	22 41	23 02	23 27	23 40	23 54	...	...	0 31
	5	21 58	22 15	22 34	22 55	23 07	23 21	23 38	23 59	...	...	0 10	0 30	0 54
	6	22 48	23 02	23 17	23 33	23 42	23 53	...	...	0 08	0 19	0 32	0 46	1 03
	7	23 34	23 44	23 54	...	...	...	0 06	0 21	0 28	0 36	0 44	0 54	1 06
	8	...	...	...	0 05	0 11	0 19	0 27	0 37	0 42	0 47	0 53	0 59	1 07
	9	0 17	0 22	0 27	0 34	0 37	0 41	0 46	0 51	0 54	0 56	0 59	1 03	1 06
	10	0 57	0 58	0 59	1 00	1 01	1 01	1 02	1 03	1 04	1 04	1 05	1 05	1 06
	11	1 36	1 33	1 29	1 26	1 23	1 21	1 18	1 14	1 13	1 11	1 09	1 07	1 05
	12	2 16	2 08	2 01	1 52	1 47	1 41	1 34	1 27	1 23	1 19	1 15	1 10	1 04
	13	2 57	2 45	2 33	2 20	2 12	2 03	1 53	1 40	1 34	1 28	1 21	1 13	1 04
	14	3 40	3 25	3 09	2 51	2 40	2 28	2 14	1 57	1 49	1 40	1 30	1 18	1 05
	15	4 26	4 08	3 49	3 26	3 13	2 58	2 40	2 18	2 08	1 56	1 42	1 27	1 08
	16	5 16	4 55	4 33	4 07	3 52	3 35	3 14	2 47	2 34	2 20	2 02	1 42	1 15
	17	6 09	5 47	5 23	4 55	4 39	4 20	3 57	3 27	3 12	2 55	2 35	2 10	1 35
	18	7 03	6 41	6 17	5 49	5 33	5 13	4 50	4 20	4 05	3 48	3 26	3 00	2 23
	19	7 58	7 37	7 14	6 48	6 33	6 15	5 53	5 25	5 12	4 56	4 38	4 15	3 45
	20	8 51	8 32	8 13	7 50	7 37	7 22	7 03	6 40	6 29	6 16	6 02	5 45	5 23
	21	9 41	9 27	9 11	8 53	8 43	8 31	8 17	7 59	7 51	7 42	7 31	7 19	7 05
	22	10 30	10 20	10 09	9 56	9 49	9 41	9 31	9 19	9 13	9 07	9 01	8 53	8 44
	23	11 17	11 11	11 05	10 59	10 55	10 50	10 45	10 39	10 36	10 33	10 29	10 25	10 21
	24	12 03	12 02	12 02	12 01	12 01	12 00	12 00	11 59	11 59	11 58	11 58	11 57	11 57
	25	12 50	12 55	12 59	13 05	13 08	13 11	13 15	13 20	13 23	13 25	13 28	13 31	13 35
	26	13 40	13 49	13 59	14 11	14 17	14 25	14 34	14 45	14 50	14 56	15 02	15 09	15 17
	27	14 33	14 47	15 02	15 20	15 30	15 42	15 56	16 13	16 21	16 30	16 41	16 52	17 06
	28	15 31	15 49	16 09	16 32	16 45	17 01	17 20	17 43	17 54	18 07	18 22	18 40	19 01
	29	16 33	16 54	17 18	17 45	18 00	18 18	18 40	19 09	19 23	19 39	19 58	20 21	20 53
	30	17 38	18 00	18 25	18 53	19 09	19 28	19 52	20 22	20 37	20 54	21 14	21 40	22 16
	31	18 41	19 03	19 27	19 53	20 09	20 27	20 49	21 17	21 30	21 46	22 04	22 26	22 55
	32	19 41	20 00	20 21	20 44	20 58	21 13	21 32	21 55	22 06	22 18	22 32	22 49	23 09

Place	Description	Altitude	Longitude
		m	h m s
Aarhus, Denmark	Ole Römer Observatory	50	-0 40 47.3 b
Abastuman, Georgian S. S. R. . .	Astrophysical Obs. of Acad. of Sciences	1580	-2 51 18.08 b
Abbadia, France	Obs. of Paris Acad. of Sci., Hendaye	69	+0 07 00.1 c
Albany, New York	Dudley Observatory	70	+4 55 07.12 c
Algiers, Algeria	Algiers Observatory, at Bouzaréah	345	-0 12 08.53 c
Alma-Ata, Kazak S. S. R. . . .	Mountain Obs. of Academy of Sciences	1450	-5 07 49.76
Amherst, Massachusetts	Amherst College Observatory	110	+4 50 05.93 a
Amsterdam, Netherlands	Tilanus Observatory	30	-0 19 38.81
Ann Arbor, Michigan	Observatory of University of Michigan	282	+5 34 55.27 c
Appleton, Wisconsin	Underwood Obs., Lawrence College	242	+5 53 35.92 a
Aretri (Florence), Italy	Astrophysical Observatory	184	-0 45 01.30 a
Armagh, Northern Ireland	Armagh Observatory	64	+0 26 35.48 b
Ashkhabad, Turkmen S. S. R. . .	Astrophysical Lab. of Acad. of Sciences	234	-3 53 24.6 b
Asiago (Vicenza), Italy	Astrophysical Obs. of Padua Univ.	1045	-0 46 06.86 b
Athens, Greece	National Observatory	110	-1 34 52.06 c
Baguio City, Philippines	Manila Observatory	1507	-8 02 19.1
Bamberg, Germany	Remeis Observatory	288	-0 43 33.57 c
Barcelona, Spain	Fabra Observatory	415	-0 08 30.2
Basel-Binningen, Switzerland . .	Astron.-Meteorol. Inst., Univ. Basel	318	-0 30 20.02
Baton Rouge, Louisiana	Observatory of University of Louisiana	31	+6 04 42.96
Beirut, Lebanon	American University Observatory	38	-2 21 52.7 a
Belgrade, Yugoslavia	Observatory of Academy of Sciences	253	-1 22 03.20
Beloit, Wisconsin	Smith Observatory, Beloit College	—	+5 56 07.4
Berkeley, California	Leuschner Observatory, Univ. of Calif.	94	+8 09 02.91
Berlin, Germany	Wilhelm Foerster Institute	40	-0 53 42
Berlin-Babelsberg, Germany . . .	Observatory of Academy of Sciences	82	-0 52 25.49 a
Berlin-Treptow, Germany	Archenhold Observatory	38	-0 53 54.2
Berne, Switzerland	Astronomical Institute of the Univ.	563	-0 29 42.88
Besançon, France	National Observatory	312	-0 23 57.42 c
Bethany, Connecticut	Yale University Observatory	213	+4 51 56.3
Beverwijk, Netherlands	Observatory of B. J. Vastenholt	3	-0 18 35.30 b
Billingshurst, Sussex	Observatory of W. B. Caunter	61	+0 02 19.0 a
Blaca, Yugoslavia	Observatory of N. Miličević	223	-1 06 08.0
Blaricum, Netherlands	Observatory of L. J. de Lange	4	-0 20 59.5 b
Bloemfontein, South Africa . . .	Boyden Station, at Mazelspoort	1387	-1 45 37.4 b
Bloemfontein, South Africa . . .	Lamont-Hussey Obs., br. of Obs. U. of Mich.	1490	-1 44 57
Bloomington, Indiana	Kirkwood Obs., University of Indiana	238	+5 46 05 c
Bogotá, Colombia	National Observatory	2640	+4 56 19.51
Bologna, Italy	University Observatory	84	-0 45 24.48
Bombay (Colaba), India	Government Observatory	14	-4 51 15.72 c
Bonn, Germany	University Observatory	62	-0 28 23.18
Bordeaux, France	Obs. of Univ. of Bordeaux, at Floirac	73	+0 02 06.60 c
Borowiec, Poland	Latitude Station of Academy of Sciences	80	-1 08 18.45
Bosque Alegre, Argentina	Branch of National Observatory	1250	+4 18 11.2 b
Boston, Massachusetts	Boston University Observatory	32	+4 44 25.5 a

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{α}	ΔZ
h m	s	° '	° ' "					
0 40.8	- 6.70	- 10 11.8	+56 07 40	+0.82663	0.55864	+1.47970	-238	-353
2 51.3	-28.14	- 42 49.5	+41 45 18.2	+0.66262	0.74730	+0.88669	-319	-283
23 53.0	+ 1.15	+ 1 45.0	+43 22 52.2	+0.68332	0.72796	+0.93868	-311	-292
19 04.9	+48.48	+ 73 46.8	+42 39 12.8	+0.67406	0.73661	+0.91508	-314	-288
0 12.1	- 1.99	- 3 02.1	+36 48 04.8	+0.59577	0.80173	+0.74310	-342	-254
5 07.8	-50.57	- 76 57.4	+43 11 16.9	+0.68102	0.73043	+0.93236	-312	-290
19 09.9	+47.66	+ 72 31.5	+42 21 56.5	+0.67037	0.74000	+0.90590	-316	-286
0 19.6	- 3.23	- 4 54.7	+52 22 18.3	+0.78833	0.61183	+1.28849	-261	-336
18 25.1	+55.02	+ 83 43.8	+42 16 48.7	+0.66928	0.74102	+0.90319	-316	-286
18 06.4	+58.09	+ 88 24.0	+44 15 39.2	+0.69440	0.71737	+0.96798	-306	-296
0 45.0	- 7.40	- 11 15.3	+43 45 14.4	+0.68804	0.72350	+0.95099	-309	-294
23 33.4	+ 4.37	+ 6 38.9	+54 21 11.1	+0.80897	0.58409	+1.38500	-249	-345
3 53.4	-38.34	- 58 21.2	+37 57 24	+0.61173	0.78951	+0.77482	-337	-261
0 46.1	- 7.58	- 11 31.7	+45 51 44.7	+0.71420	0.69771	+1.02364	-298	-305
1 34.9	-15.58	- 23 43.0	+37 58 19.7	+0.61193	0.78933	+0.77526	-337	-261
8 02.3	-79.23	-120 34.8	+16 24 39	+0.28077	0.95974	+0.29254	-409	-120
0 43.6	- 7.16	- 10 53.4	+49 53 06.4	+0.76114	0.64562	+1.17893	-275	-325
0 08.5	- 1.40	- 2 07.6	+41 24 59.3	+0.65809	0.75108	+0.87620	-320	-281
0 30.3	- 4.98	- 7 35.0	+47 32 27.2	+0.73418	0.67634	+1.08552	-289	-313
17 55.3	+59.91	+ 91 10.7	+30 24 44.1	+0.50325	0.86315	+0.58304	-368	-215
2 21.9	-23.31	- 35 28.2	+33 54 22	+0.55467	0.83083	+0.66761	-354	-237
1 22.1	-13.48	- 20 30.8	+44 48 13.2	+0.70114	0.71074	+0.98649	-303	-299
18 03.9	+58.50	+ 89 01.9	+42 30 08.4	+0.67211	0.73838	+0.91025	-315	-287
15 51.0	+80.34	+122 15.7	+37 52 23.5	+0.61057	0.79039	+0.77250	-337	-260
0 53.7	- 8.82	- 13 25.5	+52 28 30	+0.78943	0.61040	+1.29330	-260	-337
0 52.4	- 8.61	- 13 06.4	+52 24 24.2	+0.78871	0.61135	+1.29011	-261	-336
0 53.9	- 8.86	- 13 28.6	+52 29 07	+0.78954	0.61026	+1.29378	-260	-337
0 29.7	- 4.88	- 7 25.7	+46 57 12.7	+0.72726	0.68388	+1.06343	-292	-310
0 24.0	- 3.94	- 5 59.4	+47 14 59.8	+0.73075	0.68007	+1.07452	-290	-312
19 08.1	+47.96	+ 72 59.1	+41 25 37	+0.65821	0.75093	+0.87652	-320	-281
0 18.6	- 3.05	- 4 38.8	+52 29 09.0	+0.78954	0.61025	+1.29380	-260	-337
23 57.7	+ 0.38	+ 0 34.7	+51 04 51.7	+0.77439	0.62951	+1.23015	-269	-330
1 06.1	-10.86	- 16 32.0	+43 17 32.3	+0.68221	0.72904	+0.93577	-311	-291
0 21.0	- 3.45	- 5 14.9	+52 16 15.2	+0.78725	0.61322	+1.28380	-262	-336
1 45.6	-17.35	- 26 24.3	-29 02 18	-0.48262	0.87518	-0.55145	-373	+206
1 44.9	-17.24	- 26 14.3	-29 05 45	-0.48350	0.87471	-0.55276	-373	+206
18 13.9	+56.85	+ 86 31.3	+39 09 56	+0.62818	0.77640	+0.80910	-331	-268
19 03.7	+48.68	+ 74 04.9	+ 4 35 55.2	+0.07967	0.99722	+0.07989	-425	- 34
0 45.4	- 7.46	- 11 21.1	+44 29 52.8	+0.69733	0.71446	+0.97602	-305	-298
4 51.3	-47.85	- 72 48.9	+18 53 36.2	+0.32174	0.94646	+0.33995	-404	-137
0 28.4	- 4.66	- 7 05.8	+50 43 45.0	+0.77052	0.63427	+1.21481	-271	-329
23 57.9	+ 0.35	+ 0 31.6	+44 50 07	+0.70151	0.71033	+0.98758	-303	-299
1 08.3	-11.22	- 17 04.6	+52 16 38.0	+0.78733	0.61314	+1.28409	-262	-336
19 41.8	+42.41	+ 64 32.8	-31 35 53	-0.52102	0.85270	-0.61102	-364	+222
19 15.6	+46.72	+ 71 06.4	+42 21 00.6	+0.67016	0.74018	+0.90540	-316	-286

If the horizontal parallax, $\pi = 8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{\pi}{\sin \delta} \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{\alpha} \cos \theta$, $\Delta Y = \Delta_{\alpha} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
		m	h	m	s
Boulder, Colorado	Sommers-Bausch Observatory	1648	+	7 01	02.93
Brno, Czechoslovakia	Astro. Inst. of the Polytechnic School	277	-	1 06	22.3
Brno, Czechoslovakia	Masaryk University Observatory	310	-	1 06	21.10
Brooklyn, Indiana	Goethe Link Obs., Univ. of Indiana	300	+	5 45	34.86 b
Brunswick, Maine	Bowdoin College Observatory	25	+	4 39	51.3 b
Bucharest, Romania	National Observatory	83	-	1 44	23.20
Budapest, Hungary	Konkoly Observatory	474	-	1 15	51.41 c
Buenos Aires, Argentina	Naval Observatory	6	+	3 53	25.22 c
Burakan, Armenian S. S. R.	Astronomical Obs. of Acad. of Sciences	1500	-	2 57	10
Bussum, Netherlands	Observatory of D. Schmidt	10	-	0 20	41.6
Cambridge, England	University Observatories	28	-	0 00	22.75 c
Cambridge, Massachusetts	Harvard College Observatory	24	+	4 44	31.05
Canberra, Australia	Mount Stromlo Observatory	768	-	9 56	01.35 c
Cape of Good Hope, S. Africa	Royal Observatory	10	-	1 13	54 38 c
Caracas, Venezuela	Cajigal Observatory	1042	+	4 27	42.61
Carloforte, Sardinia	International Latitude Observatory	18	-	0 33	14.9 d
Castel Gandolfo, Italy	Vatican Observatory	450	-	0 50	36.33
Catania, Sicily	Astrophysical Observatory	47	-	1 00	20.60
Charlottesville, Virginia	Leander McCormick Obs., Univ. of Va.	259	+	5 14	05.33 a
Cincinnati, Ohio	Cincinnati Observatory	247	+	5 37	41.40 a
Claremont, California	F. P. Brackett Obs., Pomona College	368	+	7 50	50.68 c
Cleveland, Ohio	Warner and Swasey Observatory	247	+	5 26	16.36 c
Climax, Colorado	High Altitude Observatory	3394	+	7 04	50.27
Coimbra, Portugal	University Observatory	99	+	0 33	43.10 c
Columbia, South Carolina	Melton Memorial Obs., Univ. of S. C.	98	+	5 24	06.20 a
Columbus, Ohio	McMillin Observatory, State University	233	+	5 32	02.60 c
Coonabarabran, New South Wales	Field Station of Mount Stromlo Observatory	1164	-	9 54	44
Copenhagen, Denmark	University Observatory	14	-	0 50	18.69 a
Copenhagen, Denmark	Urania Observatory	10	-	0 50	09.11 a
Copenhagen, Denmark	Observatory of P. Darnell	—	-	0 49	48.67
Cordoba, Argentina	National Observatory	434	+	4 16	47.16
Cracow, Poland	University Observatory	221	-	1 19	50.3 a
Danzig, Danzig	Municipal Observatory	31	-	1 14	36.5
Decatur, Georgia	Bradley Obs., Agnes Scott College	315	+	5 37	10.60 b
Dehra Dun, India	Haig Obs., Trig. Survey of India	682	-	5 12	11.79
Delaware, Ohio	Perkins Obs., Ohio Wesleyan University	270	+	5 32	13.33
Denver, Colorado	Chamberlin Obs., Univ. of Denver	1644	+	6 59	47.72 a
Des Moines, Iowa	Drake University Municipal Obs.	291	+	6 14	44.7 c
Dublin, Ireland	Dunsink Observatory	86	+	0 25	21.1 c
Dunedin, New Zealand	Beverly-Begg Observatory	141	-	11 21	58.05 b
Dushanbe, Tadjik S. S. R.	Astronomical Obs. of Acad. of Sciences	820	-	4 35	07.47
Eddleston, Scotland	Earlyburn Outstation ¹	282	+	0 12	54.80
Edinburgh, Scotland	Royal Observatory	146	+	0 12	43.8 b
Evanston, Illinois	Dearborn Obs., Northwestern Univ.	175	+	5 50	41.84 c
Faenza, Italy	Urania Lamonia Observatory	51	-	0 47	30.9

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Outstation of the Royal Observatory Edinburgh

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx	ΔZ
h m	s	° '	° ' "					
16 59.0	+ 69.17	+105 15.7	+40 00 13	+0.63957	0.76727	+0.83357	-327	-273
1 06.4	- 10.90	- 16 35.6	+49 12 24	+0.75347	0.65462	+1.15099	-279	-321
1 06.4	- 10.90	- 16 35.3	+49 12 15.1	+0.75344	0.65466	+1.15089	-279	-321
18 14.4	+ 56.77	+ 86 23.7	+39 32 57.7	+0.63336	0.77217	+0.82023	-329	-270
19 20.1	+ 45.97	+ 69 57.8	+43 54 33.2	+0.68997	0.72161	+0.95616	-308	-294
1 44.4	- 17.15	- 26 05.8	+44 24 49.4	+0.69629	0.71549	+0.97315	-305	-297
1 15.9	- 12.46	- 18 57.9	+47 29 58.6	+0.73371	0.67688	+1.08396	-289	-313
20 06.6	+ 38.34	+ 58 21.3	-34 37 18.3	-0.56495	0.82382	-0.68577	-351	+241
2 57.2	- 29.10	- 44 17.5	+40 20 07	+0.64397	0.76352	+0.84341	-326	-275
0 20.7	- 3.40	- 5 10.4	+52 16 34.2	+0.78731	0.61315	+1.28405	-262	-336
0 00.4	- 0.06	- 0 05.7	+52 12 51.6	+0.78665	0.61400	+1.28119	-262	-336
19 15.5	+ 46.74	+ 71 07.8	+42 22 47.6	+0.67054	0.73983	+0.90635	-316	-286
9 56.0	- 97.91	-149 00.3	-35 19 16	-0.57499	0.81694	-0.70383	-349	+245
1 13.9	- 12.14	- 18 28.6	-33 56 02.5	-0.55507	0.83055	-0.66831	-354	+237
19 32.3	+ 43.98	+ 66 55.7	+10 30 24.3	+0.18118	0.98350	+0.18421	-420	- 77
0 33.2	- 5.46	- 8 18.7	+39 08 08.9	+0.62776	0.77670	+0.80825	-331	-268
0 50.6	- 8.31	- 12 39.1	+41 44 47.4	+0.66239	0.74726	+0.88642	-319	-283
1 00.3	- 9.91	- 15 05.1	+37 30 13.3	+0.60548	0.79431	+0.76227	-339	-258
18 45.9	+ 51.60	+ 78 31.3	+38 02 01.2	+0.61279	0.78869	+0.77697	-336	-261
18 22.3	+ 55.47	+ 84 25.3	+39 08 19.8	+0.62782	0.77669	+0.80833	-331	-268
16 09.2	+ 77.35	+117 42.7	+34 05 34.0	+0.55739	0.82905	+0.67232	-354	-238
18 33.7	+ 53.60	+ 81 34.1	+41 32 13.1	+0.65965	0.74967	+0.87992	-320	-281
16 55.2	+ 69.79	+106 12.6	+39 23 29	+0.63154	0.77429	+0.81564	-330	-269
23 26.3	+ 5.54	+ 8 25.8	+40 12 24.5	+0.64212	0.76480	+0.83959	-326	-274
18 35.9	+ 53.24	+ 81 01.6	+33 59 46.7	+0.55597	0.82996	+0.66988	-354	-237
18 28.0	+ 54.55	+ 83 00.7	+39 59 50.4	+0.63934	0.76717	+0.83338	-327	-273
9 54.7	- 97.70	-148 41	-31 16	-0.51610	0.85569	-0.60313	-365	+220
0 50.3	- 8.26	- 12 34.7	+55 41 12.6	+0.82231	0.56501	+1.45537	-241	-351
0 50.2	- 8.24	- 12 32.3	+55 41 19.2	+0.82232	0.56499	+1.45547	-241	-351
0 49.8	- 8.18	- 12 27.2	+55 42 13	+0.82247	0.56477	+1.45629	-241	-351
19 43.2	+ 42.18	+ 64 11.8	-31 25 16.4	-0.51833	0.85420	-0.60680	-364	+221
1 19.8	- 13.12	- 19 57.6	+50 03 52.0	+0.76315	0.64322	+1.18645	-274	-326
1 14.6	- 12.26	- 18 39.1	+54 21 37.9	+0.80904	0.58398	+1.38538	-249	-345
18 22.8	+ 55.39	+ 84 17.7	+33 55 54.5	+0.55506	0.83061	+0.66825	-354	-237
5 12.2	- 51.29	- 78 02.9	+30 18 51.8	+0.50184	0.86410	+0.58076	-369	-214
18 27.8	+ 54.58	+ 83 03.3	+40 15 04	+0.64273	0.76433	+0.84090	-326	-274
17 00.2	+ 68.96	+104 56.9	+39 40 36.4	+0.63520	0.77091	+0.82396	-329	-271
17 45.3	+ 61.56	+ 93 41.2	+41 35 40	+0.66040	0.74901	+0.88170	-320	-282
23 34.6	+ 4.16	+ 6 20.3	+53 23 13.1	+0.79903	0.59771	+1.33681	-255	-341
11 22.0	-112.03	-170 29.5	-45 52 25.9	-0.71424	0.69746	-1.02405	-298	+305
4 35.1	- 45.20	- 68 46.9	+38 33 39.9	+0.62005	0.78307	+0.79182	-334	-265
23 47.1	+ 2.12	+ 3 13.7	+55 44 00.4	+0.82280	0.56436	+1.45792	-241	-351
23 47.3	+ 2.09	+ 3 11.0	+55 55 30.0	+0.82466	0.56159	+1.46844	-240	-352
18 09.3	+ 57.61	+ 87 40.5	+42 03 27.2	+0.66640	0.74361	+0.89616	-317	-284
0 47.5	- 7.81	- 11 52.7	+44 17 14	+0.69471	0.71703	+0.96886	-306	-296

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta x, \cos \theta, \Delta Y = \Delta y, \sin \theta, \Delta Z$ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Fayette, Missouri	Morrison Observatory	232	+6 10 48.00
Flagstaff, Arizona	Branch of United States Naval Obs.	2310	+7 27 02.1 b
Flagstaff, Arizona	Lowell Observatory	2210	+7 26 44.6 a
Fort Davis, Texas	McDonald Obs., University of Texas	2081	+6 56 05.34
Fredericton, New Brunswick . .	Obs. of the Univ. of New Brunswick	40	+4 26 34
Gaithersburg, Maryland	International Latitude Observatory	155	+5 08 47.8 d
Geneva, New York	Smith Observatory	152	+5 08 01.00
Geneva, Switzerland	Municipal Observatory	407	-0 24 36.61 c
Genoa, Italy	Hydrographic Institute	105	-0 35 41.28 c
Gorki, R. S. F. S. R.	Latitude Station	163	-2 55 56
Göttingen, Germany	University Observatory	161	-0 39 46.22
Graz, Austria	Observatory of the University of Graz	375	-1 01 47.71 c
Greencastle, Indiana	McKim Obs., De Pauw University	262	+5 47 24.36 c
Groningen, Netherlands	Kapteyn Astronomical Laboratory	4	-0 26 15.11
Haarlem, Netherlands	Observatory of B. J. M. Walker	0	-0 18 35.47
Hamburg, Germany	German Hydrographic Institute	30	-0 39 53.44 c
Hamburg, Germany	Hamburg Observatory, at Bergedorf	41	-0 40 57.74 c
Hanover, Germany	Geodetic Institute	50	-0 38 51.3
Hanover, Germany	Obs. of Hanover Astronomical Society	50	-0 39 00.8
Hanover, New Hampshire	Shattuck Obs., Dartmouth College	183	+4 49 08.02
Hardenberg, Netherlands	Observatory of D. G. H. Kenskamp	15	-0 26 28.23 a
Harderwijk, Netherlands	Observatory of J. van Raalten	2	-0 22 29.9 b
Harestua, Norway	Observatory of the University of Oslo	585	-0 43 02
Hartbeespoort, South Africa . .	Republic Observatory Annexe	1220	-1 51 30.44 a
Harvard, Massachusetts	George R. Agassiz Sta. of Harvard Obs.	183	+4 46 14.2
Haverford, Pennsylvania	Strawbridge Mem. Obs., Haverford Coll.	116	+5 01 12.70 d
Heidelberg, Germany	State Observatory, at Königstuhl	570	-0 34 53.19 c
Helsingør, Denmark	Observatory of R. Fr. Rasmussen	—	-0 50 25.6
Helsinki, Finland	University Observatory	33	-1 39 49.10 c
Helsinki, Finland	Ursa Observatory	25	-1 39 50.09
Helsinki, Finland	Observatory of Institute of Technology	38	-1 39 44.30
Helwan, Egypt	Helwan Observatory	115	-2 05 21.87
Herstmonceux, Sussex	Royal Greenwich Observatory	34	-0 01 21.03 c
Hoher List, Germany	Hoher List Obs. of Bonn University	541	-0 27 23.9
Hoorn, Netherlands	Observatory of J. C. van der Meulen	—	-0 20 12.90 b
Hyderabad, India	Nizamiah Observatory	554	-5 13 48.98
Innsbruck, Austria	University Observatory	614	-0 45 31.4
Iowa City, Iowa	Observatory, University of Iowa	221	+6 06 08
Irkutsk, R. S. F. S. R.	Astronomical Obs. of State University	468	-6 57 22.71 c
Irkutsk, R. S. F. S. R.	City Astronomical Observatory	432	-6 57 07.1
Istanbul, Turkey	University Observatory	65	-1 55 52
Ithaca, New York	Fuertes Obs. of Cornell University	270	+5 05 54.3 a
Jakarta, Indonesia	International Latitude Observatory	23	-7 07 32 d
Jena, Germany	Karl Schwarzschild Obs. of Acad. of Sciences	331	-0 46 51
Jena, Germany	University Observatory	164	-0 46 20.22 a

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δx	ΔZ
h m	s	° '	° ' "					
17 49.2	+60.91	+ 92 42.0	+39 09 00.0	+0.62797	0.77657	+0.80865	-331	-268
16 33.0	+73.44	+111 45.5	+35 11 28	+0.57328	0.81844	+0.70045	-349	-244
16 33.3	+73.39	+111 41.1	+35 12 30.5	+0.57352	0.81826	+0.70090	-349	-245
17 03.9	+68.35	+104 01.3	+30 40 17.7	+0.50730	0.86114	+0.58910	-367	-216
19 33.4	+43.79	+ 66 38.5	+45 57.0	+0.71515	0.69650	+1.02677	-297	-305
18 51.2	+50.73	+ 77 11.9	+39 08 13.2	+0.62779	0.77670	+0.80828	-331	-268
18 52.0	+50.60	+ 77 00.3	+42 52 46.2	+0.67696	0.73395	+0.92235	-313	-289
0 24.6	- 4.04	- 6 09.2	+46 11 59.3	+0.71821	0.69340	+1.03577	-296	-306
0 35.7	- 5.86	- 8 55.3	+44 25 09.3	+0.69636	0.71542	+0.97334	-305	-297
2 55.9	-28.90	- 43 59.0	+56 15 32	+0.82791	0.55675	+1.48704	-238	-353
0 39.8	- 6.53	- 9 56.6	+51 31 48.2	+0.77930	0.62341	+1.25007	-266	-332
1 01.8	-10.15	- 15 26.9	+47 04 38.2	+0.72871	0.68228	+1.06804	-291	-311
18 12.6	+57.07	+ 86 51.1	+39 38 46.6	+0.63465	0.77109	+0.82306	-329	-271
0 26.3	- 4.31	- 6 33.8	+53 13 13.8	+0.79728	0.60003	+1.32873	-256	-340
0 18.6	- 3.05	- 4 38.9	+52 23 59.4	+0.78863	0.61144	+1.28979	-261	-336
0 39.9	- 6.55	- 9 58.4	+53 32 51.2	+0.80069	0.59546	+1.34467	-254	-342
0 41.0	- 6.73	- 10 14.4	+53 28 46.9	+0.79999	0.59641	+1.34134	-254	-341
0 38.9	- 6.38	- 9 42.8	+52 23 13	+0.78850	0.61162	+1.28919	-261	-336
0 39.0	- 6.41	- 9 45.2	+52 24 36	+0.78874	0.61130	+1.29026	-261	-337
19 10.9	+47.50	+ 72 17.0	+43 42 15.3	+0.68742	0.72410	+0.94934	-309	-293
0 26.5	- 4.35	- 6 37.1	+52 34 24.1	+0.79047	0.60904	+1.29790	-260	-337
0 22.5	- 3.70	- 5 37.5	+52 20 49.5	+0.78807	0.61217	+1.28734	-261	-336
0 43.0	- 7.07	- 10 45.5	+60 12 30	+0.86427	0.49816	+1.73495	-213	-369
1 51.5	-18.32	- 27 52.6	-25 46 22.4	-0.43224	0.90127	-0.47959	-385	+184
19 13.8	+47.02	+ 71 33.5	+42 30 13	+0.67215	0.73839	+0.91029	-315	-287
18 58.8	+49.48	+ 75 18.2	+40 00 40.1	+0.63952	0.76700	+0.83379	-327	-273
0 34.9	- 5.73	- 8 43.3	+49 23 54.6	+0.75568	0.65212	+1.15882	-278	-322
0 50.4	- 8.28	- 12 36.4	+56 02 22	+0.82576	0.55992	+1.47478	-239	-352
1 39.8	-16.40	- 24 57.3	+60 09 42.3	+0.86379	0.49882	+1.73168	-213	-369
1 39.8	-16.40	- 24 57.5	+60 09 20	+0.86374	0.49891	+1.73124	-213	-369
1 39.7	-16.38	- 24 56.1	+60 09 48	+0.86381	0.49880	+1.73179	-213	-369
2 05.4	-20.59	- 31 20.5	+29 51 31.1	+0.49494	0.86800	+0.57021	-370	-211
0 01.4	- 0.22	- 0 20.3	+50 52 18	+0.77209	0.63234	+1.22099	-270	-329
0 27.4	- 4.50	- 6 51.0	+50 09 47.1	+0.76429	0.64193	+1.19061	-274	-326
0 20.2	- 3.32	- 5 03.2	+52 38 38.4	+0.79122	0.60806	+1.30122	-259	-338
5 13.8	-51.55	- 78 27.2	+17 25 54.3	+0.29767	0.95445	+0.31188	-407	-127
0 45.5	- 7.48	- 11 22.9	+47 16 05.40	+0.73100	0.67987	+1.07521	-290	-312
17 53.9	+60.15	+ 91 32.0	+41 39 44	+0.66128	0.74822	+0.88380	-319	-282
6 57.4	-68.56	-104 20.7	+52 16 44.4	+0.78740	0.61315	+1.28418	-262	-336
6 57.1	-68.52	-104 16.8	+52 16 27	+0.78734	0.61322	+1.28395	-262	-336
1 55.9	-19.03	- 28 58.0	+41 00 45	+0.65277	0.75567	+0.86382	-322	-278
18 54.1	+50.25	+ 76 28.6	+42 27 10.4	+0.67150	0.73900	+0.90867	-315	-286
7 07.5	-70.23	-106 53.0	- 6 15 38.5	-0.10832	0.99408	-0.10897	-424	+ 46
0 46.9	- 7.70	- 11 42.8	+50 58 51	+0.77332	0.63089	+1.22575	-269	-330
0 46.3	- 7.61	- 11 35.1	+50 55 35.6	+0.77271	0.63161	+1.22339	-269	-330

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and $\theta = \text{sidereal time at } 0^{\text{h}} + \text{sidereal equivalent of U.T.} - \lambda$

Otherwise add $\Delta X = \Delta x \cos \theta$, $\Delta Y = \Delta x \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude		
			m	h	m s
Johannesburg, South Africa . . .	Republic Observatory	1806	-1	52	18.0
Juvisy, France	Flammarion Observatory	92	-0	09	29.0
Kaliningrad, R. S. F. S. R. . . .	University Observatory	24	-1	21	58.97 c
Kalocsa, Hungary	Archiepiscopal Haynald Observatory	117	-1	15	54.12 c
Kanzelhöhe, Austria	Observatory of the University of Graz	1526	-0	55	37.6
Karlsruhe, Germany	Observatory of W. Malsch	128	-0	33	32.51
Kazan, R. S. F. S. R.	Engelhardt Observatory	98	-3	15	15.74 c
Kazan, R. S. F. S. R.	Astronomical Obs. of State University	79	-3	16	29.03
Kharkov, Ukrainian S. S. R. . . .	Astronomical Obs. of State University	138	-2	24	55.72 c
Kiev, Ukrainian S. S. R.	Astronomical Obs. of State University	184	-2	02	00.56 c
Kitab, Uzbek S. S. R.	International Latitude Observatory	658	-4	27	31.7 d
Kodaikanal, India	Solar Physics Observatory	2343	-5	09	52.47
Kremsmünster, Austria	Observatory of the Benedictines	384	-0	56	31.58 c
Ksara, Syria	Ksara Observatory, near Beirut	923	-2	23	33.77
Kunming, China	National Institute of Astronomy	1940	-6	51	09.2
Kyoto, Japan	Kwasan Observatory	234	-9	03	10.40 a
Lake Angelus, Michigan	McMath-Hulbert Observatory ¹	296	+5	33	03.3
La Plata, Argentina	National University Observatory	17	+3	51	43.72 c
Leiden, Netherlands	University Observatory	6	-0	17	56.15 c
Leipzig, Germany	University Observatory	119	-0	49	33.92
Lembang, Indonesia	Bosscha Observatory	1300	-7	10	27.84
Leningrad, R. S. F. S. R.	Astronomical Obs. of State University	3	-2	01	10.71 c
Liège, Belgium	University Observatory, Cointe	127	-0	22	15.44
Lisbon, Portugal	Lisbon Observatory, at Tapada	95	+0	36	44.68 a
Lisbon, Portugal	Observatory of Faculty of Sciences	77	+0	36	35.61
Los Angeles, California	Griffith Observatory	357	+7	53	12.4 a
Louisville, Kentucky	Observatory of University of Louisville	152	+5	43	02.4 b
Lund, Sweden	Royal University Observatory	34	-0	52	44.97
Lvov, Ukrainian S. S. R.	Astronomical Institute of the University	330	-1	36	07.13
Lvov, Ukrainian S. S. R.	Observatory of the Polytechnic Institute	340	-1	36	03.40 c
Lyons, France	University Observatory	299	-0	19	08.52 c
Madison, Wisconsin	Washburn Obs., University of Wisconsin	292	+5	57	37.90 c
Madras, India	Madras Observatory	7	-5	20	59.14
Madrid, Spain	Astronomical Observatory	655	+0	14	45.10
Marseilles, France	National Observatory, at Longchamp	75	-0	21	34.55 c
Meudon, France	Observatory of Physical Astronomy	162	-0	08	55.5
Middletown, Connecticut	Van Vleck Obs., Wesleyan University	65	+4	50	38.2 a
Milan, Italy	Brera Observatory	120	-0	36	45.89 a
Mill Hill, London	Observatory of University of London	82	+0	00	57.77
Minneapolis, Minnesota	Observatory of University of Minnesota	260	+6	12	57.04 c
Mizusawa, Japan	International Latitude Observatory	61	-9	24	31.46 d
Montevideo, Uruguay	National Observatory	24	+3	44	51
Montreal, Quebec	McGill University Observatory	57	+4	54	18.63 c
Montreal, Quebec	Ville-Marie Observatory	69	+4	54	29.2
Moscow, R. S. F. S. R.	Observatory of Sternberg Inst.	166	-2	30	16.95 c

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Branch of the Observatory of the University of Michigan

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	$\Delta\alpha$	ΔZ
h m	s	° '	° ' "					
1 52.3	-18.45	- 28 04.5	-26 10 55.3	-0.43867	0.89824	-0.48837	-383	+187
0 09.5	- 1.56	- 2 22.3	+48 41 37	+0.74757	0.66135	+1.13037	-282	-319
1 22.0	-13.47	- 20 29.7	+54 42 50.5	+0.81262	0.57896	+1.40358	-247	-347
1 15.9	-12.47	- 18 58.5	+46 31 41.7	+0.72213	0.68923	+1.04773	-294	-308
0 55.6	- 9.14	- 13 54.4	+46 40 41	+0.72408	0.68749	+1.05323	-293	-309
0 33.5	- 5.51	- 8 23.1	+49 01 26.6	+0.75137	0.65701	+1.14360	-280	-321
3 15.3	-32.08	- 48 48.9	+55 50 20.2	+0.82381	0.56283	+1.46370	-240	-351
3 16.5	-32.28	- 49 07.3	+55 47 23.9	+0.82333	0.56353	+1.46102	-240	-351
2 24.9	-23.81	- 36 13.9	+50 00 09.9	+0.76245	0.64404	+1.18386	-275	-325
2 02.0	-20.04	- 30 30.1	+50 27 11.8	+0.76748	0.63800	+1.20296	-272	-327
4 27.5	-43.95	- 66 52.9	+39 08 01.7	+0.62780	0.77680	+0.80819	-331	-268
5 09.9	-50.90	- 77 28.1	+10 13 50	+0.17650	0.98457	+0.17927	-420	- 75
0 56.5	- 9.29	- 14 07.9	+48 03 23.1	+0.74023	0.66968	+1.10533	-286	-316
2 23.6	-23.58	- 35 53.4	+33 49 25.6	+0.55356	0.83174	+0.66554	-355	-236
6 51.2	-67.54	-102 47.3	+25 01 32.0	+0.42056	0.90694	+0.46371	-387	-179
9 03.2	-89.23	-135 47.6	+34 59 40.8	+0.57030	0.82014	+0.69536	-350	-243
18 26.9	+54.71	+ 83 15.8	+42 39 47.7	+0.67420	0.73652	+0.91539	-314	-288
20 08.3	+38.07	+ 57 55.9	-34 54 30.3	-0.56905	0.82097	-0.69314	-350	+243
0 17.9	- 2.95	- 4 29.0	+52 09 19.8	+0.78602	0.61481	+1.27847	-262	-335
0 49.6	- 8.14	- 12 23.5	+51 20 05.9	+0.77717	0.62606	+1.24136	-267	-332
7 10.5	-70.71	-107 37.0	- 6 49 32.9	-0.11808	0.99316	-0.11889	-424	+ 50
2 01.2	-19.91	- 30 17.7	+59 56 32.2	+0.86188	0.50214	+1.71641	-214	-368
0 22.3	- 3.66	- 5 33.9	+50 37 06	+0.76930	0.63577	+1.21002	-271	-328
23 23.3	+ 6.04	+ 9 11.2	+38 42 30.7	+0.62198	0.78138	+0.79601	-333	-265
23 23.4	+ 6.01	+ 9 08.9	+38 43 03.5	+0.62210	0.78128	+0.79627	-333	-265
16 06.8	+77.74	+118 18.1	+34 06 46.8	+0.55768	0.82886	+0.67283	-354	-238
18 17.0	+56.35	+ 85 45.6	+38 12 50	+0.61525	0.78674	+0.78202	-336	-262
0 52.7	- 8.67	- 13 11.2	+55 41 51.6	+0.82241	0.56486	+1.45596	-241	-351
1 36.1	-15.79	- 24 01.8	+49 49 57.6	+0.76056	0.64632	+1.17675	-276	-324
1 36.1	-15.78	- 24 00.8	+49 50 11.2	+0.76060	0.64628	+1.17690	-276	-325
0 19.1	- 3.14	- 4 47.1	+45 41 41.0	+0.71208	0.69972	+1.01766	-299	-304
18 02.4	+58.75	+ 89 24.5	+43 04 36.8	+0.67949	0.73162	+0.92874	-312	-290
5 21.0	-52.73	- 80 14.8	+13 04 08.0	+0.22464	0.97427	+0.23057	-416	- 96
23 45.2	+ 2.42	+ 3 41.3	+40 24 30.0	+0.64485	0.76260	+0.84560	-325	-275
0 21.6	- 3.54	- 5 23.6	+43 18 16.3	+0.68235	0.72888	+0.93616	-311	-291
0 08.9	- 1.47	- 2 13.9	+48 48 18	+0.74886	0.65990	+1.13481	-282	-319
19 09.4	+47.74	+ 72 39.5	+41 33 18	+0.65986	0.74944	+0.88048	-320	-282
0 36.8	- 6.04	- 9 11.5	+45 27 59.2	+0.70927	0.70254	+1.00958	-300	-303
23 59.0	+ 0.16	+ 0 14.4	+51 36 46.3	+0.78019	0.62227	+1.25378	-265	-333
17 47.0	+61.27	+ 93 14.3	+44 58 40.0	+0.70329	0.70860	+0.99251	-302	-300
9 24.5	-92.74	-141 07.9	+39 08 03.4	+0.62774	0.77672	+0.80820	-331	-268
20 15.2	+36.94	+ 56 12.7	-34 54 33	-0.56906	0.82097	-0.69316	-350	+243
19 05.7	+48.35	+ 73 34.7	+45 30 20	+0.70974	0.70205	+1.01096	-300	-303
19 05.5	+48.38	+ 73 37.3	+45 28 22	+0.70934	0.70246	+1.00981	-300	-303
2 30.3	-24.69	- 37 34.2	+55 45 19.8	+0.82300	0.56404	+1.45912	-241	-351

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta\alpha \cos \theta$, $\Delta Y = \Delta\alpha \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Mount Hamilton, California . . .	Lick Obs., University of California	1283	+ 8 06 34.93 c
Mount Wilson, California . . .	Observatory of Carnegie Institution	1742	+ 7 52 14.33 b
Mount Wilson, California . . .	Branch of Smithsonian Astro. Obs.	1675	+ 7 52 14.3
Munich, Germany	University Observatory	535	- 0 46 26.02
Naini Tal, India	Uttar Pradesh State Observatory	1927	- 5 17 49.71
Nanking, China	Purple Mountain Observatory	367	- 7 55 17.02
Nantucket, Massachusetts . . .	Maria Mitchell Observatory	20	+ 4 40 25.15 a
Naples, Italy	Astronomical Obs., at Capodimonte	164	- 0 57 01.41 a
Nashville, Tennessee	Arthur J. Dyer Obs., Vanderbilt Univ.	345	+ 5 47 13.27 b
Neuchâtel, Switzerland	Cantonal Observatory	488	- 0 27 49.79 c
New Haven, Connecticut	Yale University Observatory	21	+ 4 51 41.97
New Plymouth, New Zealand . .	Obs. of New Plymouth Astronomical Soc.	49	-11 36 17.77 a
New York, New York	Columbia University Observatory	25	+ 4 55 50
Nice, France	Nice Observatory, at Mont Gros	376	- 0 29 12.10 c
Nikolaev, Ukrainian S. S. R. . .	Astronomical Observatory	54	- 2 07 53.92 c
Norman, Oklahoma	Observatory of University of Oklahoma	363	+ 6 29 46.48
Northampton, Massachusetts . .	Smith College Observatory	70	+ 4 50 33.10 c
Northfield, Minnesota	Goodsell Observatory, Carleton College	290	+ 6 12 35.92 c
Oakland, California	Chabot Observatory	99	+ 8 08 48
Odessa, Ukrainian S. S. R. . . .	Odessa Observatory	53	- 2 03 01.98
Ondřejov, Czechoslovakia . . .	Astrophysical Observatory	533	- 0 59 08.08
Orono, Maine	Observatory of University of Maine	38	+ 4 34 40.3
Ottawa, Ontario	Dominion Observatory	87	+ 5 02 51.95 c
Oxford, England	University Observatory	64	+ 0 05 00.4 c
Oxford, Mississippi	Obs. of University of Mississippi	161	+ 5 58 07.18
Padua, Italy	Astronomical Observatory	38	- 0 47 29.15
Palermo, Sicily	University Astronomical Observatory	72	- 0 53 25.87
Palomar Mountain, California . .	Palomar Observatory ¹	1706	+ 7 47 27.36 b
Paris, France	Observatory of Paris ²	67	- 0 09 20.91 c
Perth, Western Australia	Government Observatory	65	- 7 43 21.62 a
Philadelphia, Pennsylvania . . .	Flower and Cook Obs., Univ. of Pa.	155	+ 5 01 54.33 b
Philadelphia, Pennsylvania . . .	Students' Obs., Univ. of Pennsylvania	21	+ 5 00 44
Philadelphia, Pennsylvania . . .	Franklin Institute Observatory	30	+ 5 00 41.6 a
Pic du Midi, France	Observatory of University of Toulouse	2862	- 0 00 34.16 a
Pittsburgh, Pennsylvania	Allegheny Obs. of the University	370	+ 5 20 05.34 a
Pola, Italy	Observatory of Hydrographic Office	32	- 0 55 23.07 c
Poltava, Ukrainian S. S. R. . . .	Gravimetric Observatory	151	- 2 18 11.2
Portage Lake, Michigan	Portage Lake Observatory ³	321	+ 5 35 41.93 b
Potsdam, Germany	Astrophysical Observatory	107	- 0 52 15.86 a
Potsdam, Germany	Geodetic Institute ⁴	109	- 0 52 16.11
Poughkeepsie, New York	Vassar College Observatory	61	+ 4 55 35.16 a
Poznań, Poland	University Observatory	85	- 1 07 30.78 a
Prague, Czechoslovakia	Stefánik Observatory	327	- 0 57 35.8
Prague, Czechoslovakia	Astronomical Institute of Charles Univ.	267	- 0 57 34.88
Prague, Czechoslovakia	Technical University Observatory	237	- 0 57 40.92

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

¹ Of Carnegie Institution of Washington and California Institute of Technology² Cassini's Meridian³ Branch of the Observatory of University of Michigan⁴ Helmert Tower; zero of the German triangulation

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{α}	ΔZ
h m	s	° '	° ' "					
15 53.4	+ 79.93	+121 38.7	+37 20 25.3	+0.60334	0.79619	+0.75778	-340	-257
16 07.8	+ 77.58	+118 03.6	+34 12 59.5	+0.55929	0.82802	+0.67545	-353	-239
16 07.8	+ 77.58	+118 03.6	+34 12 55	+0.55927	0.82803	+0.67542	-353	-239
0 46.4	- 7.63	- 11 36.5	+48 08 45.5	+0.74129	0.66854	+1.10882	-285	-316
5 17.8	- 52.21	- 79 27.4	+29 21 38.90	+0.48755	0.87252	+0.55879	-372	-208
7 55.3	- 78.08	-118 49.3	+32 03 59.9	+0.52787	0.84828	+0.62228	-362	-225
19 19.6	+ 46.07	+ 70 06.3	+41 16 50	+0.65627	0.75259	+0.87202	-321	-280
0 57.0	- 9.37	- 14 15.4	+40 51 45.7	+0.65080	0.75739	+0.85927	-323	-278
18 12.8	+ 57.04	+ 86 48.3	+36 03 08.5	+0.58528	0.80947	+0.72305	-345	-250
0 27.8	- 4.57	- 6 57.4	+46 59 50.6	+0.72777	0.68331	+1.06506	-292	-310
19 08.3	+ 47.92	+ 72 55.5	+41 18 58.4	+0.65674	0.75218	+0.87311	-321	-280
11 36.3	-114.38	-174 04.4	-39 03 45.2	-0.62677	0.77750	-0.80614	-332	+267
19 04.2	+ 48.60	+ 73 57.5	+40 48 34.6	+0.65009	0.75798	+0.85766	-323	-277
0 29.2	- 4.80	- 7 18.0	+43 43 17.0	+0.68765	0.72392	+0.94990	-309	-293
2 07.9	- 21.01	- 31 58.5	+46 58 18.5	+0.72742	0.68359	+1.06411	-292	-310
17 30.2	+ 64.03	+ 97 26.6	+35 12 08.3	+0.57326	0.81808	+0.70074	-349	-245
19 09.4	+ 47.73	+ 72 38.3	+42 19 01.9	+0.66974	0.74057	+0.90436	-316	-286
17 47.4	+ 61.21	+ 93 09.0	+44 27 41.6	+0.69690	0.71493	+0.97478	-305	-297
15 51.2	+ 80.30	+122 12.0	+37 47 00	+0.60934	0.79134	+0.77000	-338	-260
2 03.0	- 20.21	- 30 45.5	+46 28 37.5	+0.72151	0.68987	+1.04586	-294	-308
0 59.1	- 9.71	- 14 47.0	+49 54 38.1	+0.76146	0.64531	+1.18000	-275	-325
19 25.3	+ 45.12	+ 68 40.1	+44 54 00	+0.70231	0.70953	+0.98982	-303	-300
18 57.1	+ 49.75	+ 75 43.0	+45 23 38.1	+0.70838	0.70344	+1.00703	-300	-302
23 55.0	+ 0.82	+ 1 15.1	+51 45 34.2	+0.78177	0.62026	+1.26040	-265	-334
18 01.9	+ 58.83	+ 89 31.8	+34 22 12.6	+0.56136	0.82631	+0.67935	-353	-239
0 47.5	- 7.80	- 11 52.3	+45 24 01.3	+0.70846	0.70335	+1.00726	-300	-302
0 53.4	- 8.78	- 13 21.5	+38 06 43.6	+0.61385	0.78782	+0.77917	-336	-262
16 12.5	+ 76.79	+116 51.8	+33 21 22.4	+0.54685	0.83635	+0.65386	-357	-233
0 09.3	- 1.54	- 2 20.2	+48 50 11	+0.74921	0.65948	+1.13607	-281	-320
7 43.4	- 76.12	-115 50.4	-31 57 10.7	-0.52617	0.84929	-0.61954	-362	+224
18 58.1	+ 49.60	+ 75 28.6	+39 59 57	+0.63936	0.76714	+0.83343	-327	-273
18 59.3	+ 49.40	+ 75 11.0	+39 57	+0.63869	0.76767	+0.83198	-328	-272
18 59.3	+ 49.40	+ 75 10.4	+39 57 27.6	+0.63879	0.76759	+0.83221	-327	-273
0 00.6	- 0.09	- 0 08.5	+42 56 12.0	+0.67797	0.73358	+0.92420	-313	-289
18 39.9	+ 52.58	+ 80 01.3	+40 28 58.1	+0.64581	0.76173	+0.84782	-325	-276
0 55.4	- 9.10	- 13 50.8	+44 51 48.6	+0.70186	0.70998	+0.98856	-303	-299
2 18.2	- 22.70	- 34 32.8	+49 36 13.0	+0.75796	0.64935	+1.16725	-277	-323
18 24.3	+ 55.15	+ 83 55.5	+42 24 10.7	+0.67087	0.73959	+0.90708	-316	-286
0 52.3	- 8.59	- 13 04.0	+52 22 56.0	+0.78845	0.61169	+1.28897	-261	-336
0 52.3	- 8.59	- 13 04.0	+52 22 54.8	+0.78845	0.61170	+1.28895	-261	-336
19 04.4	+ 48.56	+ 73 53.8	+41 41 18	+0.66160	0.74789	+0.88461	-319	-282
1 07.5	- 11.09	- 16 52.7	+52 23 54.3	+0.78862	0.61147	+1.28972	-261	-336
0 57.6	- 9.46	- 14 23.9	+50 04 56	+0.76336	0.64299	+1.18720	-274	-326
0 57.6	- 9.46	- 14 23.7	+50 04 36.0	+0.76329	0.64306	+1.18696	-274	-326
0 57.7	- 9.48	- 14 25.2	+50 04 40.2	+0.76330	0.64304	+1.18701	-274	-326

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and $\theta = \text{sidereal time at } 0^{\text{h}} + \text{sidereal equivalent of U.T.} - \lambda$

Otherwise add $\Delta X = \Delta_{\alpha} \cos \theta$, $\Delta Y = \Delta_{\alpha} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Pretoria, South Africa	Radcliffe Observatory	1542	- 1 52 54.9 b
Pretoria, South Africa	Observatory of S. C. Venter	1234	- 1 52 46.9
Princeton, New Jersey	Princeton University Observatory	43	+ 4 58 35.59
Princeton, New Jersey	Obs. of Instruction, Princeton Univ.	65	+ 4 58 37.61 c
Providence, Rhode Island	Ladd Observatory, Brown University	69	+ 4 45 35.95 a
Pulkovo, R. S. F. S. R.	Astronomical Obs. of Acad. of Sciences	75	- 2 01 18.57
Quebec, Canada	Quebec Observatory, Plains of Abraham	90	+ 4 44 52.71 c
Quito, Ecuador	National Observatory	2908	+ 5 13 58.20
Reutlingen, Germany	Popular Observatory	401	- 0 36 49.11
Richmond, Florida	Branch of United States Naval Obs.	—	+ 5 21 31.3 d
Richmond Hill, Ontario	David Dunlap Obs., Univ. of Toronto	244	+ 5 17 41.3
Riga, Latvian S. S. R.	Polytechnic School Observatory	—	- 1 36 28.10
Rio de Janeiro, Brazil	National Observatory	33	+ 2 52 53.5 c
Rio de Janeiro, Brazil	Mount Valongo Obs., Univ. of Brazil	52	+ 2 52 44.66 a
Rome, Italy	Rome Observatory, on Monte Mario	152	- 0 49 48.55 c
St. Louis, Missouri	Washington University Observatory	178	+ 6 01 13.3
Saint Michel, France	Observatory of Haute-Provence	651	- 0 22 51.34
San Fernando, Spain	Naval Observatory	30	+ 0 24 49.30
Santa Clara, California	Obs. of University of Santa Clara	31	+ 8 07 48
Santiago, Chile	National Observatory	860	+ 4 42 11.7
São Paulo, Brazil	Astronomical and Geophysical Institute	800	+ 3 06 29.44
Scottsdale, Arizona	Mummy Mountain Astronomical Obs.	433	+ 7 27 49.93
Sendai, Japan	Tohoku University Observatory	36	- 9 23 29.49
Sidmouth, Devon	Norman Lockyer Observatory	171	+ 0 12 52.5 a
Simeis, Crimea, R. S. F. S. R.	Crimean Astrophysical Observatory	346	- 2 15 59.38
Skalnáté Pleso, Czechoslovakia	Astronomical Observatory	1783	- 1 20 58.8 b
Sneek, Netherlands	Observatory of A. Mak	0	- 0 22 39.46 a
Sonneberg, Germany	Sonneberg Observatory	640	- 0 44 46.19 a
South Bethlehem, Pennsylvania	Sayre Observatory, Lehigh University	110	+ 5 01 31.96 a
South Hadley, Massachusetts	Williston Obs., Mount Holyoke Coll.	76	+ 4 50 18.99 a
Stockholm, Sweden	Stockholm Observatory, at Saltsjöbaden	55	- 1 13 14 c
Strasbourg, France	University Observatory	156	- 0 31 04.25 a
Stuttgart, Germany	Swabian Observatory	344	- 0 36 47.39
Sunspot, New Mexico	Sacramento Peak Observatory	2811	+ 7 03 16.6
Swarthmore, Pennsylvania	Sproul Observatory, Swarthmore College	63	+ 5 01 25.62 a
Sydney, New South Wales	Government Observatory	44	-10 04 49.19
Sydney, New South Wales	Riverview College Observatory	26	-10 04 37.99 a
Syracuse, New York	Syracuse University Observatory	160	+ 5 04 33.36
Szombathely (Savaria), Hungary	Gothard Astrophysical Observatory	232	- 1 06 29.78
Tacubaya, Mexico	National Observatory	2297	+ 6 36 46.74
Tanakami, Japan	Yamamoto Observatory	165	- 9 03 57.4
Tartu, Estonian S. S. R.	Astronomical Obs. of Acad. of Sciences	67	- 1 46 53.18 c
Tashkent, Uzbek S. S. R.	Tashkent Observatory	477	- 4 37 10.47 c
Teramo, Italy	Collurania Observatory	398	- 0 54 56

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{α}	ΔZ
h m s		° ' "	° ' "					
1 52.9	- 18.55	- 28 13.7	-25 47 18	-0.43250	0.90120	-0.47992	-384	+185
1 52.8	- 18.53	- 28 11.7	-25 40 15	-0.43064	0.90204	-0.47741	-385	+184
19 01.4	+ 49.05	+ 74 38.9	+40 20 47.7	+0.64397	0.76322	+0.84375	-326	-275
19 01.4	+ 49.06	+ 74 39.4	+40 20 57.8	+0.64401	0.76320	+0.84383	-326	-275
19 14.4	+ 46.92	+ 71 24.0	+41 50 15.6	+0.66354	0.74616	+0.88927	-318	-283
2 01.3	- 19.93	- 30 19.6	+59 46 18.5	+0.86039	0.50472	+1.70469	-215	-367
19 15.1	+ 46.80	+ 71 13.2	+46 47 59.2	+0.72537	0.68579	+1.05772	-293	-309
18 46.0	+ 51.58	+ 78 29.6	- 0 14 00	-0.00405	1.00045	-0.00404	-427	+ 2
0 36.8	- 6.05	- 9 12.3	+48 29 25.9	+0.74527	0.66404	+1.12232	-283	-318
18 38.5	+ 52.82	+ 80 22.8	+25 37 28	+0.42983	0.90222	+0.47642	-385	-183
18 42.3	+ 52.19	+ 79 25.3	+43 51 46	+0.68942	0.72219	+0.95461	-308	-294
1 36.5	- 15.85	- 24 07.0	+56 57 09.3	+0.83456	0.54662	+1.52675	-233	-356
21 07.1	+ 28.40	+ 43 13.4	-22 53 42.2	-0.38663	0.92169	-0.41948	-393	+165
21 07.3	+ 28.38	+ 43 11.2	-22 53 51.3	-0.38667	0.92168	-0.41953	-393	+165
0 49.8	- 8.18	- 12 27.2	+41 55 19.2	+0.66464	0.74519	+0.89191	-318	-284
17 58.8	+ 59.34	+ 90 18.3	+38 38 57.0	+0.62118	0.78203	+0.79432	-334	-265
0 22.9	- 3.75	- 5 42.8	+43 55 45.6	+0.69030	0.72144	+0.95683	-308	-294
23 35.2	+ 4.08	+ 6 12.3	+36 27 42.0	+0.59100	0.80522	+0.73396	-344	-252
15 52.2	+ 80.13	+121 57.0	+37 20 45	+0.60329	0.79598	+0.75793	-340	-257
19 17.8	+ 46.36	+ 70 32.9	-33 23 50	-0.54737	0.83584	-0.65488	-357	+233
20 53.5	+ 30.64	+ 46 37.4	-23 39 06.9	-0.39875	0.91661	-0.43503	-391	+170
16 32.2	+ 73.57	+111 57.5	+33 33 19.82	+0.54963	0.83426	+0.65882	-356	-234
9 23.5	- 92.57	-140 52.4	+38 15 14.9	+0.61579	0.78629	+0.78315	-335	-263
23 47.1	+ 2.11	+ 3 13.1	+50 41 13.3	+0.77007	0.63485	+1.21299	-271	-329
2 16.0	- 22.34	- 33 59.8	+44 24 11.6	+0.69618	0.71565	+0.97280	-305	-297
1 21.0	- 13.30	- 20 14.7	+49 11 20.0	+0.75344	0.65501	+1.15027	-279	-321
0 22.7	- 3.72	- 5 39.9	+53 02 25.0	+0.79540	0.60255	+1.32005	-257	-339
0 44.8	- 7.35	- 11 11.5	+50 22 41.4	+0.76670	0.63906	+1.19974	-273	-327
18 58.5	+ 49.53	+ 75 23.0	+40 36 23.2	+0.64742	0.76029	+0.85154	-324	-276
19 09.7	+ 47.69	+ 72 34.7	+42 15 18.2	+0.66894	0.74130	+0.90239	-316	-285
1 13.2	- 12.03	- 18 18.5	+59 16 18	+0.85596	0.51225	+1.67099	-219	-365
0 31.1	- 5.10	- 7 46.1	+48 35 02.1	+0.74631	0.66279	+1.12601	-283	-318
0 36.8	- 6.04	- 9 11.8	+48 47 00.7	+0.74863	0.66020	+1.13395	-282	-319
16 56.7	+ 69.53	+105 49.2	+32 47 12	+0.53864	0.84189	+0.63980	-359	-230
18 58.6	+ 49.52	+ 75 21.4	+39 54 16.2	+0.63809	0.76819	+0.83064	-328	-272
10 04.8	- 99.36	-151 12.3	-33 51 41.1	-0.55402	0.83126	-0.66648	-355	+236
10 04.6	- 99.33	-151 09.5	-33 49 45.7	-0.55356	0.83157	-0.66568	-355	+236
18 55.4	+ 50.03	+ 76 08.3	+43 02 13.1	+0.67896	0.73208	+0.92744	-312	-290
1 06.5	- 10.92	- 16 37.4	+47 13 53.48	+0.73052	0.68030	+1.07382	-290	-312
17 23.2	+ 65.18	+ 99 11.7	+19 24 17.9	+0.33025	0.94388	+0.34989	-403	-141
9 04.0	- 89.36	-135 59.3	+34 58 18	+0.56996	0.82036	+0.69477	-350	-243
1 46.9	- 17.56	- 26 43.3	+58 22 47.2	+0.84790	0.52557	+1.61327	-224	-362
4 37.2	- 45.53	- 69 17.6	+41 19 30.4	+0.65690	0.75213	+0.87339	-321	-280
0 54.9	- 9.02	- 13 44.0	+42 39 27	+0.67414	0.73660	+0.91521	-314	-288

If the horizontal parallax, $\pi = 8''.50/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{\alpha} \cos \theta$, $\Delta Y = \Delta_{\alpha} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Tisvildeleje, Denmark	Observatory of N.P. Wieth-Knudsen	35	- 0 48 23.8
Tokyo, Japan	Tokyo Astronomical Obs., at Mitaka	59	- 9 18 10.10 c
Tomsk, R. S. F. S. R.	University Observatory	130	- 5 39 47.16
Tonantzintla, Mexico	National Astrophysical Observatory	2150	+ 6 33 15.32
Toronto, Canada	Meteorological Observatory	116	+ 5 17 35.60 c
Toruń, Poland	Copernicus University Obs., at Piwnice	90	- 1 14 13.1
Toulouse, France	University Observatory	195	- 0 05 51.01 c
Trieste, Italy	Astronomical Observatory	67	- 0 55 04.9
Troy, New York	Obs. of Rensselaer Polytechnic Inst.	82	+ 4 54 43
Tsingtao, China	Observatory of Tsingtao	78	- 8 01 16.71 c
Tucson, Arizona	Catalina Station, University of Arizona	—	+ 7 22 52
Tucson, Arizona	Kitt Peak National Observatory	2064	+ 7 26 22.72
Tucson, Arizona	Steward Obs., University of Arizona	757	+ 7 23 47.68 b
Turin, Italy	Pino Torinese Observatory	618	- 0 31 05.95 c
Turku, Finland	University Observatory	28	- 1 28 55.03 b
Uccle, Belgium	Royal Observatory	105	- 0 17 25.97 c
Ukiah, California	International Latitude Observatory	200	+ 8 12 50.3 d
University, Alabama	Observatory, University of Alabama	87	+ 5 50 10.2
Uppsala, Sweden	University Astronomical Observatory	21	- 1 10 30.17 a
Urbana, Illinois	Observatory, University of Illinois	236	+ 5 52 53.90 a
Utrecht, Netherlands	Sonnenborgh Observatory	14	- 0 20 31.01 a
Venice, Italy	Observatory of the Nautical Institute	15	- 0 49 22.12 c
Victoria, British Columbia	Dominion Astrophysical Observatory	229	+ 8 13 40.17 b
Vienna, Austria	Kuffner Observatory	293	- 1 05 10.96
Vienna, Austria	University Observatory	240	- 1 05 21.35 c
Vilnius, Lithuanian S. S. R.	University Observatory	122	- 1 41 08.76 a
Warsaw, Poland	Observatory of the Technical University	144	- 1 24 02.4
Warsaw, Poland	University Observatory	121	- 1 24 07.26
Washington, D. C.	United States Naval Observatory	86*	+ 5 08 15.78 a
Washington, D. C.	Georgetown College Observatory	62	+ 5 08 18.3 a
Washington, D. C.	Smithsonian Astrophysical Observatory	10	+ 5 08 06.24
Weesp, Netherlands	Observatory of J. van Diggelen	—	- 0 20 09.38
Wellesley, Massachusetts	Whitin Observatory, Wellesley College	61	+ 4 45 13.3
Wellington, New Zealand	Carter Observatory	129	-11 39 03.69 a
Williams Bay, Wisconsin	Yerkes Obs., University of Chicago	334	+ 5 54 13.64 a
Williamstown, Massachusetts	Field Memorial Obs., Williams College	213	+ 4 52 50
Wilmington, Delaware	Mt. Cuba Astronomical Observatory	90	+ 5 02 32 b
Wrocław, Poland	University Observatory	117	- 1 08 21.22
Würzburg, Germany	University Observatory	200	- 0 39 44.71
Zagreb, Yugoslavia	Observatory of Faculty of Technology	146	- 1 04 05.11
Zô-Sê, China	Astronomical Observatory	100	- 8 04 44.75 a
Zürich, Switzerland	Obs. of Swiss Polytechnic School	469	- 0 34 12.26 c

a Equatorial refractor

b Equatorial reflector

c Transit or meridian circle

d Zenith telescope

* Bench mark in clock house; $\lambda = +5^{\circ} 08' 15''.78$, $\phi = +38^{\circ} 55' 14''.0$.

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{α}	ΔZ
h m	s	° '	° ' "					
0 48.4	- 7.95	- 12 06.0	+56 03 03	+0.82587	0.55976	+1.47541	-239	-352
9 18.2	- 91.69	-139 32.5	+35 40 21.4	+0.57990	0.81330	+0.71302	-347	-247
5 39.8	- 55.82	- 84 56.8	+56 28 06.3	+0.82993	0.55370	+1.49888	-236	-354
17 26.7	+ 64.60	+ 98 18.8	+19 01 57.9	+0.32414	0.94599	+0.34265	-404	-138
18 42.4	+ 52.17	+ 79 23.9	+43 40 00.8	+0.68694	0.72454	+0.94810	-309	-293
1 14.2	- 12.19	- 18 33.3	+53 05 47.7	+0.79600	0.60177	+1.32276	-257	-340
0 05.9	- 0.96	- 1 27.8	+43 36 44.1	+0.68626	0.72521	+0.94629	-309	-293
0 55.1	- 9.05	- 13 46.2	+45 38 35.5	+0.71142	0.70034	+1.01583	-299	-304
19 05.3	+ 48.42	+ 73 40.8	+42 43 45	+0.67503	0.73572	+0.91751	-314	-288
8 01.3	- 79.06	-120 19.2	+36 04 11.3	+0.58550	0.80925	+0.72351	-345	-250
16 37.1	+ 72.75	+110 43	+32 24	+0.53274	0.84514	+0.63035	-361	-227
16 33.6	+ 73.33	+111 35.7	+31 57 30.32	+0.52641	0.84951	+0.61967	-362	-225
16 36.2	+ 72.90	+110 56.9	+32 13 59.4	+0.53035	0.84680	+0.62630	-361	-226
0 31.1	- 5.11	- 7 46.5	+45 02 16.3	+0.70407	0.70790	+0.99459	-302	-300
1 28.9	- 14.61	- 22 13.8	+60 27 08.7	+0.86631	0.49441	+1.75221	-211	-370
0 17.4	- 2.86	- 4 21.5	+50 47 55.0	+0.77129	0.63334	+1.21782	-270	-329
15 47.2	+ 80.96	+123 12.6	+39 08 12.0	+0.62779	0.77671	+0.80827	-331	-268
18 09.8	+ 57.52	+ 87 32.6	+33 12 33	+0.54457	0.83753	+0.65021	-357	-232
1 10.5	- 11.58	- 17 37.5	+59 51 29.4	+0.86114	0.50341	+1.71061	-215	-367
18 07.1	+ 57.97	+ 88 13.5	+40 06 20.2	+0.64079	0.76596	+0.83658	-327	-273
0 20.5	- 3.37	- 5 07.8	+52 05 09.6	+0.78528	0.61577	+1.27528	-263	-335
0 49.4	- 8.11	- 12 20.5	+45 26 10.5	+0.70889	0.70290	+1.00852	-300	-302
15 46.3	+ 81.10	+123 25.0	+48 31 15.7	+0.74560	0.66362	+1.12353	-283	-318
1 05.2	- 10.71	- 16 17.7	+48 12 46.7	+0.74204	0.66764	+1.11143	-285	-317
1 05.4	- 10.74	- 16 20.3	+48 13 55.1	+0.74225	0.66739	+1.11217	-285	-317
1 41.1	- 16.62	- 25 17.2	+54 40 59.1	+0.81232	0.57941	+1.40198	-247	-347
1 24.0	- 13.80	- 21 00.6	+52 13 21	+0.78675	0.61390	+1.28157	-262	-336
1 24.1	- 13.82	- 21 01.8	+52 13 04.6	+0.78670	0.61396	+1.28135	-262	-336
18 51.7	+ 50.64	+ 77 03.9	+38 55 14.0	+0.62486	0.77906	+0.80206	-332	-267
18 51.7	+ 50.65	+ 77 04.6	+38 54 26.0	+0.62467	0.77921	+0.80168	-332	-267
18 51.9	+ 50.61	+ 77 01.6	+38 53 17.3	+0.62441	0.77941	+0.80113	-333	-266
0 20.2	- 3.31	- 5 02.3	+52 18 11.8	+0.78760	0.61277	+1.28530	-261	-336
19 14.8	+ 46.85	+ 71 18.3	+42 17 37.1	+0.66943	0.74084	+0.90361	-316	-286
11 39.1	-114.84	-174 45.9	-41 17 03.9	-0.65634	0.75256	-0.87214	-321	+280
18 05.8	+ 58.19	+ 88 33.4	+42 34 13.4	+0.67302	0.73762	+0.91242	-315	-287
19 07.2	+ 48.10	+ 73 12.5	+42 42 30	+0.67477	0.73598	+0.91684	-314	-288
18 57.5	+ 49.70	+ 75 38.0	+39 47 03	+0.63648	0.76953	+0.82710	-328	-272
1 08.4	- 11.23	- 17 05.3	+51 06 42.1	+0.77473	0.62910	+1.23150	-268	-331
0 39.7	- 6.53	- 9 56.2	+49 47 27.6	+0.76008	0.64687	+1.17501	-276	-324
1 04.1	- 10.53	- 16 01.3	+45 49 32.3	+0.71365	0.69807	+1.02232	-298	-304
8 04.7	- 79.63	-121 11.2	+31 05 47.6	+0.51348	0.85708	+0.59910	-366	-219
0 34.2	- 5.62	- 8 33.1	+47 22 38.3	+0.73227	0.67845	+1.07932	-289	-312

If the horizontal parallax, $\pi = 8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \frac{\pi}{\sin \delta} \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{\alpha} \cos \theta$, $\Delta Y = \Delta_{\delta} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Achimota, Ghana	University of Ghana	18	+ 0 00 54.67
Arcetri (Florence), Italy . .	Astrophysical Observatory	184	- 0 45 01.30
Arecibo, Puerto Rico . . .	Arecibo Ionospheric Obs., Cornell Univ.	364	+ 4 27 00.70
Berlin-Adlershof, Germany .	Heinrich-Hertz Institute	50	- 0 54 09.7
Bethany, Connecticut . . .	Yale University Observatory	213	+ 4 51 56.3
Big Pine, California	California Institute of Technology	1216	+ 7 53 10.56
Boulder, Colorado	High Altitude Observatory, Univ. of Colorado	1692	+ 7 01 05.87
Boulder, Colorado	National Bureau of Standards Field Station	1595	+ 7 00 29.47
Cambridge, England	Mullard Radio Astro. Obs., Univ. of Cambridge	26	- 0 00 09.6
Cedar Rapids, Iowa	Feather Ridge Observatory	275	+ 6 06 59.3
Christchurch, New Zealand .	Aerospace Field Station, U. of Canterbury	35	-11 29 37.33
College, Alaska	Stanford Research Institute	122	+ 9 50 36.0
College, Alaska	Geophysical Institute of University of Alaska	172	+ 9 51 20
Columbus, Ohio	Radio Observatory, Ohio State University	245	+ 5 32 10.24
Crimea, R. S. F. S. R. . . .	Crimean Astrophysical Observatory	550	- 2 16 04
Danville, Illinois	Vermilion River Observatory, University of Illinois	202	+ 5 50 15.65
Delaware, Ohio	Ohio State-Ohio Wesleyan Radio Observatory	282	+ 5 32 11.56
Derwood, Maryland	Carnegie Institution of Washington	140	+ 5 08 36.3
Dwingeloo, Netherlands . .	Foundation for Radio Astronomy	25	- 0 25 35.25
Eschweiler, Germany	Stockert Radio Obs. of Bonn University	435	- 0 26 53.48
Fort Davis, Texas	Radio Astronomy Station of Harvard Col. Obs.	1580	+ 6 55 48
Freiburg, Germany	Fraunhofer Institute	1240	- 0 31 37.4
Gainesville, Florida	Observatory of the University of Florida	38	+ 5 29 22.47
Goldstone, California	Jet Propulsion Lab., Calif. Inst. of Tech.	1038	+ 7 47 23.58
Göteborg, Sweden	Onsala Obs., Chalmers Univ. of Technology	14	- 0 47 40
Grafton, New York	Sampson Sta., Rensselaer Polytechnic Inst.	493	+ 4 53 48
Green Bank, West Virginia .	National Radio Astronomy Observatory	823	+ 5 19 20.7
Hamilton, Massachusetts . .	Sagamore Hill Radio Observatory, U.S.A.F.	—	+ 4 43 15.69
Harestua, Norway	Observatory of the University of Oslo	585	- 0 43 02
Harvard, Massachusetts . .	George R. Agassiz Station of Harvard Obs.	183	+ 4 46 14.2
Hat Creek, California	Radio Observatory, Univ. of California	1050	+ 8 05 53.52
Helsinki, Finland	Radio Astronomy Station, Univ. of Helsinki	2	- 1 40 02
Hiraiso, Japan	Hiraiso Radio Wave Observatory	26	- 9 22 29.5
Humain, Belgium	Humain Station, Royal Obs. of Belgium	294	- 0 21 01.7
Ikomasan, Japan	Ikomasan Observatory, Kyoto University	634	- 9 02 41.52
Ithaca, New York	Radio Astronomy Laboratory, Cornell Univ.	341	+ 5 05 48.46
Jodrell Bank, Cheshire . . .	Nuffield Radio Ast. Lab., Univ. of Manchester	70	+ 0 09 13.47
Kiel, Germany	Radio Observatory, University of Kiel	38	- 0 40 29.0
Kingston, Ontario	Radio Observatory, Queen's University	110	+ 5 06 32
Lwiro, Congo	Radio Astronomy Observing Station of Lwiro	1700	- 1 55 16
Malvern, England	Royal Radar Establishment	20	+ 0 08 35.3
Nançay, France	Radio Obs. of Nançay, Observatory of Paris	150	- 0 08 47.3
Nederhorst den Berg, Netherlands .	Radio Astronomy Section, NERA	0	- 0 20 18.5
Newstead, New York	Radio Physics Observatory of Cornell Univ.	238	+ 5 14 14.9
Ottawa, Ontario	Shirley Bay Radio Observatory	70	+ 5 03 39.5

$-\lambda$	Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{θ}	ΔZ
h m	s	° '	° ' "					
23 59.1	+ 0.15	+ 0 13.7	+ 5 38	+0.09750	0.99521	+0.09797	-425	- 42
0 45.0	- 7.40	- 11 15.3	+43 45 14.4	+0.68804	0.72350	+0.95099	-309	-294
19 33.0	+43.86	+ 66 45.2	+18 20 46.2	+0.31276	0.94954	+0.32938	-405	-133
0 54.2	- 8.90	- 13 32.4	+52 25 45	+0.78895	0.61104	+1.29116	-261	-337
19 08.1	+47.96	+ 72 59.1	+41 25 37	+0.65821	0.75093	+0.87652	-320	-281
16 06.8	+77.73	+118 17.6	+37 13 53.8	+0.60183	0.79733	+0.75480	-340	-257
16 58.9	+69.18	+105 16.5	+40 04 42	+0.64057	0.76644	+0.83578	-327	-273
16 59.5	+69.08	+105 07.4	+40 05 28	+0.64073	0.76628	+0.83616	-327	-273
0 00.2	- 0.03	- 0 02.4	+52 09 45	+0.78610	0.61472	+1.27880	-262	-335
17 53.0	+60.29	+ 91 44.8	+42 04 59	+0.66674	0.74333	+0.89696	-317	-284
11 29.6	-113.29	-172 24.3	-43 37 10	-0.68633	0.72510	-0.94653	-309	+293
14 09.4	+97.02	+147 39.0	+64 44 00	+0.90075	0.42802	+2.10447	-183	-384
14 08.7	+97.14	+147 50.0	+64 52.4	+0.90180	0.42581	+2.11786	-182	-385
18 27.8	+54.57	+ 83 02.6	+40 01 00.2	+0.63960	0.76695	+0.83395	-327	-273
2 16.1	-22.35	- 34 01.0	+44 43.7	+0.70024	0.71170	+0.98390	-304	-299
18 09.7	+57.54	+ 87 33.9	+40 03 36.0	+0.64018	0.76646	+0.83523	-327	-273
18 27.8	+54.57	+ 83 02.9	+40 15 04.7	+0.64273	0.76432	+0.84091	-326	-274
18 51.4	+50.70	+ 77 09.1	+39 07 15	+0.62757	0.77687	+0.80781	-331	-268
0 25.6	- 4.20	- 6 23.8	+52 48 46.7	+0.79301	0.60571	+1.30921	-258	-338
0 26.9	- 4.42	- 6 43.4	+50 34 14	+0.76881	0.63645	+1.20797	-272	-328
17 04.2	+68.30	+103 57.0	+30 38	+0.50668	0.86141	+0.58820	-367	-216
0 31.6	- 5.20	- 7 54.4	+47 54 50	+0.73866	0.67162	+1.09982	-286	-315
18 30.6	+54.11	+ 82 20.6	+29 38 36	+0.49168	0.86984	+0.56525	-371	-210
16 12.6	+76.78	+116 50.9	+35 23 34.2	+0.57603	0.81625	+0.70570	-348	-246
0 47.7	- 7.83	- 11 55.0	+57 23.5	+0.83872	0.54018	+1.55265	-230	-358
19 06.2	+48.26	+ 73 27	+42 47 35	+0.67589	0.73501	+0.91956	-314	-288
18 40.7	+52.46	+ 79 50.2	+38 26 17	+0.61837	0.78440	+0.78834	-335	-264
19 16.7	+46.53	+ 70 48.9	+42 37 51.2	+0.67376	0.73687	+0.91435	-314	-287
0 43.0	- 7.07	- 10 45.5	+60 12 30	+0.86427	0.49816	+1.73495	-213	-369
19 13.8	+47.02	+ 71 33.5	+42 30 13	+0.67215	0.73839	+0.91029	-315	-287
15 54.1	+79.82	+121 28.4	+40 49 04.6	+0.65031	0.75800	+0.85792	-323	-277
1 40.0	-16.43	- 25 00.5	+60 13.4	+0.86432	0.49788	+1.73600	-212	-369
9 22.5	-92.40	-140 37.4	+36 21 54	+0.58964	0.80621	+0.73137	-344	-252
0 21.0	- 3.45	- 5 15.4	+50 11 30	+0.76458	0.64152	+1.19182	-274	-326
9 02.7	-89.15	-135 40.4	+34 40 33.6	+0.56578	0.82336	+0.68716	-351	-241
18 54.2	+50.24	+ 76 27.1	+42 29 18	+0.67197	0.73859	+0.90980	-315	-287
23 50.8	+ 1.52	+ 2 18.4	+53 14 11	+0.79746	0.59982	+1.32950	-256	-340
0 40.5	- 6.65	- 10 07.2	+54 20 32	+0.80885	0.58424	+1.38444	-249	-345
18 53.5	+50.36	+ 76 38	+44 15	+0.69425	0.71749	+0.96761	-306	-296
1 55.3	-18.94	- 28 49	- 2 16	-0.03930	0.99949	-0.03932	-426	+ 17
23 51.4	+ 1.41	+ 2 08.8	+52 05 40	+0.78537	0.61565	+1.27567	-263	-335
0 08.8	- 1.44	- 2 11.8	+47 22 48	+0.73227	0.67838	+1.07942	-289	-312
0 20.3	- 3.34	- 5 04.6	+52 14 03	+0.78686	0.61373	+1.28210	-262	-336
18 45.8	+51.62	+ 78 33.7	+42 59 25.5	+0.67838	0.73264	+0.92594	-313	-289
18 56.3	+49.88	+ 75 54.9	+45 23 45	+0.70840	0.70341	+1.00710	-300	-302

If the horizontal parallax, $\pi=8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin \delta \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos \delta \sin \delta)$$

where $\delta = \theta - \alpha$ and θ = sidereal time at 0h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{\theta} \cos \theta$, $\Delta Y = \Delta_{\theta} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

Place	Description	Altitude	Longitude
		m	h m s
Palo Alto, California . . .	Stanford Research Institute	168	+ 8 08 42.3
Penticton, British Columbia .	Dominion Radio Astrophysical Observatory	550	+ 7 58 28.53
Portage Lake, Michigan . . .	Radio Astronomy Obs., Univ. of Michigan	345	+ 5 35 44.5
Potsdam, Germany	Astrophysical Obs., German Acad. of Sciences	35	- 0 52 32.8
Pulkovo, R. S. F. S. R. . . .	Astronomical Obs., Acad. of Sciences	70	- 2 01 17.47
Richmond Hill, Ontario . . .	Radio Observatory, University of Toronto	244	+ 5 17 41.0
Riverside, Maryland	Maryland Point Obs., Naval Research Lab.	30	+ 5 08 55.83
Saint Michel, France	National Center of Scientific Research	614	- 0 22 50
South Gloucester, Ontario . .	Goth Hill Obs., Nat. Research Coun. of Canada	122	+ 5 02 20.67
Stanford, California	Radio Astronomy Institute., Stanford Univ.	80	+ 8 08 45.2
Sydney, New South Wales . . .	Dapto Field Station, Government Observatory	8	-10 03 02.0
Sydney, New South Wales . . .	Parkes Field Station, Government Obs.	315	- 9 53 03.33
Tokyo, Japan	Tokyo Astronomical Observatory at Mitaka	70	- 9 18 09.6
Tortosa, Spain	Observatory of Ebro	53	- 0 01 58
Toyokawa, Japan	Toyokawa Observatory, Nagoya University	16	- 9 09 29.2
Tübingen, Germany	Astronomical Institute of Tübingen Univ.	470	- 0 36 13.5
Tyngsboro, Massachusetts . . .	Haystack Site, Lincoln Laboratory	145	+ 4 45 57.20
University, Alabama	Observatory, University of Alabama	87	+ 5 50 10.2
Washington, D.C.	Radio Astronomy Obs., Naval Research Lab.	30	+ 5 08 06.45
Westford, Massachusetts . . .	Millstone Radar, Lincoln Laboratory	156	+ 4 45 57.93

-λ		Redn. of S. T.	Longitude	Latitude	$\rho \sin \phi'$	$\rho \cos \phi'$	$\tan \phi'$	Δ_{xy}	ΔZ
h	m	s	° ' "	° ' "					
15	51.3	+80.28	+122 10.6	+37 24 15	+0.60412	0.79538	+0.75953	-339	-258
16	01.5	+78.60	+119 37.1	+49 19 16	+0.75480	0.65314	+1.15565	-279	-322
18	24.3	+55.15	+ 83 56.1	+42 23 52.5	+0.67081	0.73965	+0.90692	-316	-286
0	52.5	- 8.63	- 13 08.2	+52 17 06.3	+0.78741	0.61303	+1.28446	-262	-336
2	01.3	-19.92	- 30 19.4	+59 46 05.5	+0.86036	0.50477	+1.70444	-215	-367
18	42.3	+52.19	+ 79 25.2	+43 51 44	+0.68941	0.72220	+0.95459	-308	-294
18	51.1	+50.75	+ 77 14.0	+38 22 26.1	+0.61742	0.78500	+0.78652	-335	-263
0	22.8	- 3.75	- 5 42.5	+43 55	+0.69013	0.72159	+0.95641	-308	-294
18	57.7	+49.67	+ 75 35.2	+45 17 45.7	+0.70719	0.70466	+1.00359	-301	-302
15	51.2	+80.29	+122 11.3	+37 23.9	+0.60403	0.79543	+0.75937	-339	-258
10	03.0	-99.06	-150 45.5	-34 28.3	-0.56280	0.82530	-0.68194	-352	+240
9	53.1	-97.42	-148 15.8	-32 59 55	-0.54153	0.83956	-0.64501	-358	+231
9	18.2	-91.69	-139 32.4	+35 40 18.2	+0.57989	0.81331	+0.71300	-347	-247
0	02.0	- 0.32	- 0 29.5	+40 49.2	+0.65023	0.75786	+0.85798	-323	-277
9	09.5	-90.27	-137 22.3	+34 50 06	+0.56800	0.82170	+0.69125	-351	-242
0	36.2	- 5.95	- 9 03.4	+48 32 20	+0.74583	0.66342	+1.12423	-283	-318
19	14.0	+46.97	+ 71 29.3	+42 37 23	+0.67367	0.73698	+0.91410	-314	-287
18	09.8	+57.52	+ 87 32.6	+33 12 33	+0.54457	0.83753	+0.65021	-357	-232
18	51.9	+50.61	+ 77 01.6	+38 49 16.6	+0.62351	0.78014	+0.79922	-333	-266
19	14.0	+46.98	+ 71 29.5	+42 37 02.4	+0.67360	0.73705	+0.91392	-314	-287

If the horizontal parallax, $\pi = 8''.80/\text{distance}$, is known the parallax corrections are:

$$\Delta\alpha = \pi \times \rho \cos \phi' \sin h \sec \delta \quad \Delta\delta = \pi \times \rho \cos \phi' (\tan \phi' \cos \delta - \cos h \sin \delta)$$

where $h = \theta - \alpha$ and θ = sidereal time at 0^h + sidereal equivalent of U.T. - λ

Otherwise add $\Delta X = \Delta_{xy} \cos \theta$ $\Delta Y = \Delta_{xy} \sin \theta$, ΔZ to solar coordinates to eliminate parallax.

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Actual names of observatories are in bold type.

Names of owners of private observatories are in italics.

Radio observatories are designated by R.

Name, Etc.	Place	Name, Etc.	Place
Abo	Turku	Colorado, Univ. of	Climax
Agassiz Station	Harvard	Columbia University . . .	New York
Agnes Scott College	Decatur	Copernicus University . . .	Toruń
Alabama, Univ. of	University	Cordoba (Branch)	Bosque Alegre
Alaska, Univ. of, R.	College	Cornell University, R	Arecibo
Allegheny	Pittsburgh	Cornell University	Ithaca
American Univ.	Beirut	Cornell Univ. (Branch), R . .	Newstead
Archenhold	Berlin-Treptow	Crimean Astrophysical, R . .	Crimea
Archiepiscopal Haynald . . .	Kalocsa	Crimean Astrophysical . . .	Simeis
Arizona, Univ. of	Tucson		
Baden	Heidelberg	Dapto Field Station, R. . . .	Sydney
Batavia	Jakarta	<i>Darnell</i>	Copenhagen
Belgian Royal, R	Humain	Dartmouth College	Hanover
Bergedorf	Hamburg	David Dunlap	Richmond Hill
Beverly-Begg	Dunedin	Dearborn	Evanston
Bloomington (Branch)	Brooklyn	<i>de Lange</i>	Blaricum
Bonn University (Branch), R .	Eschweiler	De Pauw University	Greencastle
Bonn University (Branch) . .	Hoher List	Dominion	Ottawa
Boscha	Lembang	Dominion Astrophysical, R . .	Penticton
Bouzaréah	Algiers	Dominion Astrophysical . . .	Victoria
Bowdoin College	Brunswick	Drake University	Des Moines
Boyden Station	Bloemfontein	Dudley	Albany
Brackett	Claremont	Dunsink	Dublin
Bradley	Decatur	Dyer	Nashville
Brera	Milan		
Breslau	Wroclaw	Earlyburn	Eddleston
Brown University	Providence	Ebro, R	Tortosa
Brussels	Uccle	Eidgenössische Sternwarte . .	Zürich
		Engelhardt	Kazan
Cajigal	Caracas		
California Inst. of Tech., R. .	Big Pine	Fabra	Barcelona
California Inst. of Tech. . . .	Palomar Mt.	Feather Ridge, R	Cedar Rapids
California, Univ. of	Berkeley	Field Memorial	Williamstown
California, Univ. of, R	Hat Creek	Flammarion	Juvisy
California, Univ. of	Mount Hamilton	Floirac	Bordeaux
Canterbury, Univ. of, R	Christchurch	Florence	Arcetri
Capodimonte	Naples	Florida, Univ. of, R.	Gainesville
Carleton College	Northfield	Flower and Cook	Philadelphia
Carnegie Institution, R.	Derwood	Franklin Institute	Philadelphia
Carnegie Institution	Mount Wilson	Fraunhofer, R.	Freiburg
Carnegie Institution	Palomar Mt.	Fuertes	Ithaca
Carter	Wellington		
Catalina Station	Tucson	Georgetown College	Washington
<i>Caunter</i>	Billingshurst	German Acad. of Sci., R . . .	Potsdam
Chabot	Oakland	Ghana, Univ. of, R	Achimota
Chalmers Univ. of Tech., R. .	Gothenburg	Goethe Link	Brooklyn
Chamberlin	Denver	Goodsell	Northfield
Charles University	Prague	Gothard	Szombathely
Chicago, Univ. of	Williams Bay	Goth Hill, R.	South Gloucester
Cointe	Liège	Graz, Univ. of	Kanzelhöhe
Colaba	Bombay	Griffith	Los Angeles
Collurania	Teramo		
Colorado, Univ. of, R	Boulder	Haig	Dehra Dun
		Harvard College (Branch) . .	Bloemfontein

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Name, Etc.	Place	Name, Etc.	Place
Harvard College	Cambridge	Manila	Baguio City
Harvard College (Branch), R. . .	Fort Davis	Maria Mitchell	Nantucket
Harvard College (Branch) . .	Harvard	Masaryk University	Brno
Haute-Provence	Saint Michel	Mazelspoort	Bloemfontein
Heinrich-Hertz Inst., R. . .	Berlin-Adlershof	McDonald	Fort Davis
Hendaye	Abbadia	McGill University	Montreal
High Altitude, R.	Boulder	McKim	Greencastle
High Altitude	Climax	McMath-Hulbert	Lake Angelus
 		McMillin	Columbus
Illinois, Univ. of, R.	Danville	Melton Memorial	Columbia
Illinois, Univ. of	Urbana	Michigan, Univ. of	Ann Arbor
India, Survey of	Dehra Dun	Michigan, Univ. of (Branch).	Bloemfontein
Indiana, Univ. of	Bloomington	Michigan, Univ. of (Branch).	Lake Angelus
Indiana, Univ. of	Brooklyn	Michigan, Univ. of (Branch).	Portage Lake
International Latitude . .	Carloforte	<i>Milicevic</i>	Blaca
International Latitude . .	Gaithersburg	Minnesota, Univ. of	Minneapolis
International Latitude . .	Jakarta	Mississippi, Univ. of	Oxford
International Latitude . .	Kitab	Mitaka	Tokyo
International Latitude . .	Mizusawa	Monte Mario	Rome
International Latitude . .	Ukiah	Mont Gros	Nice
Iowa, Univ. of	Iowa City	Morrison	Fayette
 		Mount Cuba	Wilmington
Jet Propulsion Lab., R. . .	Goldstone	Mount Holyoke College . .	South Hadley
 		Mount Locke	Fort Davis
Kapteyn Laboratory	Groningen	Mount Stromlo	Canberra
Karl Schwarzschild	Jena	Mount Stromlo (Field Sta.) .	Coonabarabran
<i>Kenskamp</i>	Hardenberg	Mount Valongo	Rio de Janeiro
Kirkwood	Bloomington	Mullard, R.	Cambridge
Kitt Peak National	Tucson	Mummy Mountain	Scottsdale
Königstuhl	Heidelberg	 	
Konkoly	Budapest	Nagoya Univ., R.	Toyokawa
Kuffner	Vienna	Nat. Bu. of Standards, R. . .	Boulder
Kwasan	Kyoto	National Radio, R.	Green Bank
Kyoto Univ., R.	Ikomasan	Naval Research Lab., R. . .	Riverside
 		Naval Research Lab., R. . .	Washington
Ladd	Providence	Netherlands Foundation, R. .	Dwingeloo
Lamont-Hussey	Bloemfontein	New Brunswick, Univ. of . .	Fredericton
Lawrence College	Appleton	Nizamiah	Hyderabad
Leander McCormick	Charlottesville	Norman Lockyer	Sidmouth
Lehigh University	South Bethlehem	Northwestern Univ.	Evanston
Leuschner	Berkeley	Nuffield, R.	Jodrell Bank
Lick	Mount Hamilton	 	
Lincoln Laboratory, R. . .	Tyngsboro	Ohio State Univ.	Columbus
Lincoln Laboratory, R. . .	Westford	Ohio Wesleyan Univ.	Delaware
Link	Brooklyn	Oklahoma, Univ. of	Norman
London, Univ. of	Mill Hill	Ole Römer	Aarhus
Longchamp	Marseilles	Onsala, R.	Gothenburg
Louisiana, Univ. of	Baton Rouge	Oslo, Univ. of	Harestua
Lowell	Flagstaff	 	
 		Padua, Univ. of	Asiago
Maine, Univ. of	Orono	Paris, R.	Nançay
Mak	Sneek	Parkes Field Station, R. . .	Sydney
Malsch	Karlsruhe	Pennsylvania, Univ. of . .	Philadelphia
Manchester, Univ. of, R. . .	Jodrell Bank		

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Name, Etc.	Place	Name, Etc.	Place
Perkins	Delaware	Tapada	Lisbon
Pino Torinese	Turin	Texas, Univ. of	Fort Davis
Piwnice	Toruń	Tilanus	Amsterdam
Pomona College	Claremont	Tohoku University	Sendai
Purple Mountain	Nanking	Toronto, Univ. of	Richmond Hill
Queen's Univ., R.	Kingston	Toulouse, Univ. of	Pic du Midi
Radcliffe	Pretoria	Underwood	Appleton
<i>Rasmussen</i>	Helsingör	Urania	Copenhagen
Remeis	Bamberg	Urania Lamonia	Faenza
Rensselaer Poly. Inst., R.	Grafton	Ursa	Helsinki
Rensselaer Poly. Inst	Troy	U. S. Naval (Branch)	Flagstaff
Republic (Annexe)	Hartbeespoort	U. S. Naval (Branch)	Richmond
Republic	Johannesburg	U. S. Naval	Washington
Riverview College	Sydney	Uttar Pradesh	Naini Tal
Royal Greenwich	Herstmonceux	Vanderbilt University	Nashville
Rutherford	New York	<i>van der Meulen</i>	Hoorn
Sacramento Peak	Sunspot	<i>van Diggelen</i>	Weesp
Sagamore Hill, R.	Hamilton	<i>van Raalten</i>	Harderwijk
Saltsjöbaden	Stockholm	Van Vleck	Middletown
Sampson Station, R.	Grafton	Vassar College	Poughkeepsie
Sayre	South Bethlehem	<i>Vastenholt</i>	Beverwijk
<i>Schmidt, D.</i>	Bussum	Vatican	Castel Gandolfo
Shattuck	Hanover	<i>Venter</i>	Pretoria
Shirley Bay, R.	Ottawa	Vermilion River, R	Danville
Smith	Beloit	Vicenza	Asiago
Smith	Geneva	Ville-Marie	Montreal
Smith College	Northampton	Virginia, Univ. of	Charlottesville
Smithsonian (Branch)	Mount Wilson	<i>Walker</i>	Haarlem
Smithsonian	Washington	Warner and Swasey	Cleveland
Sommers-Bausch	Boulder	Washburn	Madison
Sonnenborgh	Utrecht	Washington University	St. Louis
South Carolina, Univ. of	Columbia	Wesleyan University	Middletown
Sproul	Swarthmore	Whitin	Wellesley
Stanford Research Inst., R.	College	<i>Wieth-Knudsen, N. P.</i>	Tisvildeleje
Stanford Research Inst., R.	Palo Alto	Wilhelm Foerster Institute	Berlin
Stefánik	Prague	Williams College	Williamstown
Sternberg Institute	Moscow	Williston	South Hadley
Steward	Tucson	Wisconsin, Univ. of	Madison
Stockert, R.	Eschweiler	Yale University (Branch).	Bethany
Strawbridge Memorial	Haverford	Yale University	New Haven
Swabian	Stuttgart	Yamamoto	Tanakami
		Yerkes	Williams Bay

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON OF JANUARY 0

Julian Calendar						This table gives the Julian Day numbers for January 0 of every leap year from A. D. 1100 to A. D. 1896, and the reductions to be applied to them to obtain the numbers for January 0 of the leap years in other centuries from 1697 B. C. to A. D. 2296, except in the 20th century which is tabulated on the following two pages.					
Subtract		CENTURY YEARS									
102 2700	B. C.	1600	1500	1400	1300		Gregorian Calendar				
87 6600		1200	1100	1000	900						
73 0500		800	700	600	500						
58 4400		400	300	200	100						
43 8300		0	...	...	...			
43 8300	A. D.	...	0	100	200	1500	CENTURY YEARS				
29 2200		300	400	500	600						
14 6100		700	800	900	1000		1600	1700	1800		
0		1100	1200	1300	1400						
LEAP YEARS											
B. C.	A. D.	Julian				Add 14 6097 for					
—	0	212 2832	215 9357	219 5882	223 2407	226 8932	230 5447	*234 1971	*237 8495		
97	4	212 4293	216 0818	219 7343	223 3868	227 0393	230 6908	234 3432	237 9956		
93	8	212 5754	216 2279	219 8804	223 5329	227 1854	230 8369	234 4893	238 1417		
89	12	212 7215	216 3740	220 0265	223 6790	227 3315	230 9830	234 6354	238 2878		
85	16	212 8676	216 5201	220 1726	223 8251	227 4776	231 1291	234 7815	238 4339		
81	20	213 0137	216 6662	220 3187	223 9712	227 6237	231 2752	234 9276	238 5800		
77	24	213 1598	216 8123	220 4648	224 1173	227 7698	231 4213	235 0737	238 7261		
73	28	213 3059	216 9584	220 6109	224 2634	227 9159	231 5674	235 2198	238 8722		
69	32	213 4520	217 1045	220 7570	224 4095	228 0620	231 7135	235 3659	239 0183		
65	36	213 5981	217 2506	220 9031	224 5556	228 2081	231 8596	235 5120	239 1644		
61	40	213 7442	217 3967	221 0492	224 7017	228 3542	232 0057	235 6581	239 3105		
57	44	213 8903	217 5428	221 1953	224 8478	228 5003	232 1518	235 8042	239 4566		
53	48	214 0364	217 6889	221 3414	224 9939	228 6464	232 2979	235 9503	239 6027		
49	52	214 1825	217 8350	221 4875	225 1400	228 7925	232 4440	236 0964	239 7488		
45	56	214 3286	217 9811	221 6336	225 2861	228 9386	232 5901	236 2425	239 8949		
41	60	214 4747	218 1272	221 7797	225 4322	229 0847	232 7362	236 3886	240 0410		
37	64	214 6208	218 2733	221 9258	225 5783	229 2308	232 8823	236 5347	240 1871		
33	68	214 7669	218 4194	222 0719	225 7244	229 3769	233 0284	236 6808	240 3332		
29	72	214 9130	218 5655	222 2180	225 8705	229 5230	233 1745	236 8269	240 4793		
25	76	215 0591	218 7116	222 3641	226 0166	229 6691	233 3206	236 9730	240 6254		
21	80	215 2052	218 8577	222 5102	226 1627	229 8152	233 4667	237 1191	240 7715		
17	84	215 3513	219 0038	222 6563	226 3088	Gregorian	229 9603	233 6128	237 2652	240 9176	
13	88	215 4974	219 1499	222 8024	226 4549	230 1064	233 7589	237 4113	241 0637		
9	92	215 6435	219 2960	222 9485	226 6010	230 2525	233 9050	237 5574	241 2098		
5	96	215 7896	219 4421	223 0946	226 7471	230 3986	234 0511	237 7035	241 3559		
1	—	215 9357	219 5882	223 2407	226 8932	*For Jan. —1; these century years are not leap years.					

*For Jan. —1; these century years are not leap years.

In the following table, for dates from 1582 October 15 to 1583 December 31 inclusive, Gregorian calendar, *diminish all numbers by 10*.

In century years of the Gregorian calendar that are not leap years, for *January 0* use the number 1 instead of the tabular value 0, and for *February 0* use 32 instead of 31.

YEARS AFTER LEAP YEAR**	MONTHS											
	Add to January 0 of leap year											
	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
0	0	31	60	91	121	152	182	213	244	274	305	335
1	366	397	425	456	486	517	547	578	609	639	670	700
2	731	762	790	821	851	882	912	943	974	1004	1035	1065
3	1096	1127	1155	1186	1216	1247	1277	1308	1339	1369	1400	1430

**Reckoned from successive leap years, always in the direction of increasing J. D. Number.

TABLE I

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON, A. D. 1900-1950

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
1900	241 5020	5051	5079	5110	5140	5171	5201	5232	5263	5293	5324	5354
1901	5385	5416	5444	5475	5505	5536	5566	5597	5628	5658	5689	5719
1902	5750	5781	5809	5840	5870	5901	5931	5962	5993	6023	6054	6084
1903	6115	6146	6174	6205	6235	6266	6296	6327	6358	6388	6419	6449
1904	6480	6511	6540	6571	6601	6632	6662	6693	6724	6754	6785	6815
1905	241 6846	6877	6905	6936	6966	6997	7027	7058	7089	7119	7150	7180
1906	7211	7242	7270	7301	7331	7362	7392	7423	7454	7484	7515	7545
1907	7576	7607	7635	7666	7696	7727	7757	7788	7819	7849	7880	7910
1908	7941	7972	8001	8032	8062	8093	8123	8154	8185	8215	8246	8276
1909	8307	8338	8366	8397	8427	8458	8488	8519	8550	8580	8611	8641
1910	241 8672	8703	8731	8762	8792	8823	8853	8884	8915	8945	8976	9006
1911	9037	9068	9096	9127	9157	9188	9218	9249	9280	9310	9341	9371
1912	9402	9433	9462	9493	9523	9554	9584	9615	9646	9676	9707	9737
1913	9768	9799	9827	9858	9888	9919	9949	9980	*0011	*0041	*0072	*0102
1914	242 0133	0164	0192	0223	0253	0284	0314	0345	0376	0406	0437	0467
1915	242 0498	0529	0557	0588	0618	0649	0679	0710	0741	0771	0802	0832
1916	0863	0894	0923	0954	0984	1015	1045	1076	1107	1137	1168	1198
1917	1229	1260	1288	1319	1349	1380	1410	1441	1472	1502	1533	1563
1918	1594	1625	1653	1684	1714	1745	1775	1806	1837	1867	1898	1928
1919	1959	1990	2018	2049	2079	2110	2140	2171	2202	2232	2263	2293
1920	242 2324	2355	2384	2415	2445	2476	2506	2537	2568	2598	2629	2659
1921	2690	2721	2749	2780	2810	2841	2871	2902	2933	2963	2994	3024
1922	3055	3086	3114	3145	3175	3206	3236	3267	3298	3328	3359	3389
1923	3420	3451	3479	3510	3540	3571	3601	3632	3663	3693	3724	3754
1924	3785	3816	3845	3876	3906	3937	3967	3998	4029	4059	4090	4120
1925	242 4151	4182	4210	4241	4271	4302	4332	4363	4394	4424	4455	4485
1926	4516	4547	4575	4606	4636	4667	4697	4728	4759	4789	4820	4850
1927	4881	4912	4940	4971	5001	5032	5062	5093	5124	5154	5185	5215
1928	5246	5277	5306	5337	5367	5398	5428	5459	5490	5520	5551	5581
1929	5612	5643	5671	5702	5732	5763	5793	5824	5855	5885	5916	5946
1930	242 5977	6008	6036	6067	6097	6128	6158	6189	6220	6250	6281	6311
1931	6342	6373	6401	6432	6462	6493	6523	6554	6585	6615	6646	6676
1932	6707	6738	6767	6798	6828	6859	6889	6920	6951	6981	7012	7042
1933	7073	7104	7132	7163	7193	7224	7254	7285	7316	7346	7377	7407
1934	7438	7469	7497	7528	7558	7589	7619	7650	7681	7711	7742	7772
1935	242 7803	7834	7862	7893	7923	7954	7984	8015	8046	8076	8107	8137
1936	8168	8199	8228	8259	8289	8320	8350	8381	8412	8442	8473	8503
1937	8534	8565	8593	8624	8654	8685	8715	8746	8777	8807	8838	8868
1938	8899	8930	8958	8989	9019	9050	9080	9111	9142	9172	9203	9233
1939	9264	9295	9323	9354	9384	9415	9445	9476	9507	9537	9568	9598
1940	242 9629	9660	9689	9720	9750	9781	9811	9842	9873	9903	9934	9964
1941	9995	*0026	*0054	*0085	*0115	*0146	*0176	*0207	*0238	*0268	*0299	*0329
1942	243 0360	0391	0419	0450	0480	0511	0541	0572	0603	0633	0664	0694
1943	0725	0756	0784	0815	0845	0876	0906	0937	0968	0998	1029	1059
1944	1090	1121	1150	1181	1211	1242	1272	1303	1334	1364	1395	1425
1945	243 1456	1487	1515	1546	1576	1607	1637	1668	1699	1729	1760	1790
1946	1821	1852	1880	1911	1941	1972	2002	2033	2064	2094	2125	2155
1947	2186	2217	2245	2276	2306	2337	2367	2398	2429	2459	2490	2520
1948	2551	2582	2611	2642	2672	2703	2733	2764	2795	2825	2856	2886
1949	2917	2948	2976	3007	3037	3068	3098	3129	3160	3190	3221	3251
1950	243 3282	3313	3341	3372	3402	3433	3463	3494	3525	3555	3586	3616

JULIAN DAY NUMBER

DAYS ELAPSED AT GREENWICH NOON, A. D. 1950-2000

Year	Jan. 0	Feb. 0	Mar. 0	Apr. 0	May 0	June 0	July 0	Aug. 0	Sept. 0	Oct. 0	Nov. 0	Dec. 0
1950	243 3282	3313	3341	3372	3402	3433	3463	3494	3525	3555	3586	3616
1951	3647	3678	3706	3737	3767	3798	3828	3859	3890	3920	3951	3981
1952	4012	4043	4072	4103	4133	4164	4194	4225	4256	4286	4317	4347
1953	4378	4409	4437	4468	4498	4529	4559	4590	4621	4651	4682	4712
1954	4743	4774	4802	4833	4863	4894	4924	4955	4986	5016	5047	5077
1955	243 5108	5139	5167	5198	5228	5259	5289	5320	5351	5381	5412	5442
1956	5473	5504	5533	5564	5594	5625	5655	5686	5717	5747	5778	5808
1957	5839	5870	5898	5929	5959	5990	6020	6051	6082	6112	6143	6173
1958	6204	6235	6263	6294	6324	6355	6385	6416	6447	6477	6508	6538
1959	6569	6600	6628	6659	6689	6720	6750	6781	6812	6842	6873	6903
1960	243 6934	6965	6994	7025	7055	7086	7116	7147	7178	7208	7239	7269
1961	7300	7331	7359	7390	7420	7451	7481	7512	7543	7573	7604	7634
1962	7665	7696	7724	7755	7785	7816	7846	7877	7908	7938	7969	7999
1963	8030	8061	8089	8120	8150	8181	8211	8242	8273	8303	8334	8364
1964	8395	8426	8455	8486	8516	8547	8577	8608	8639	8669	8700	8730
1965	243 8761	8792	8820	8851	8881	8912	8942	8973	9004	9034	9065	9095
1966	9126	9157	9185	9216	9246	9277	9307	9338	9369	9399	9430	9460
1967	9491	9522	9550	9581	9611	9642	9672	9703	9734	9764	9795	9825
1968	9856	9887	9916	9947	9977	*0008	*0038	*0069	*0100	*0130	*0161	*0191
1969	244 0222	0253	0281	0312	0342	0373	0403	0434	0465	0495	0526	0556
1970	244 0587	0618	0646	0677	0707	0738	0768	0799	0830	0860	0891	0921
1971	0952	0983	1011	1042	1072	1103	1133	1164	1195	1225	1256	1286
1972	1317	1348	1377	1408	1438	1469	1499	1530	1561	1591	1622	1652
1973	1683	1714	1742	1773	1803	1834	1864	1895	1926	1956	1987	2017
1974	2048	2079	2107	2138	2168	2199	2229	2260	2291	2321	2352	2382
1975	244 2413	2444	2472	2503	2533	2564	2594	2625	2656	2686	2717	2747
1976	2778	2809	2838	2869	2899	2930	2960	2991	3022	3052	3083	3113
1977	3144	3175	3203	3234	3264	3295	3325	3356	3387	3417	3448	3478
1978	3509	3540	3568	3599	3629	3660	3690	3721	3752	3782	3813	3843
1979	3874	3905	3933	3964	3994	4025	4055	4086	4117	4147	4178	4208
1980	244 4239	4270	4299	4330	4360	4391	4421	4452	4483	4513	4544	4574
1981	4605	4636	4664	4695	4725	4756	4786	4817	4848	4878	4909	4939
1982	4970	5001	5029	5060	5090	5121	5151	5182	5213	5243	5274	5304
1983	5335	5366	5394	5425	5455	5486	5516	5547	5578	5608	5639	5669
1984	5700	5731	5760	5791	5821	5852	5882	5913	5944	5974	6005	6035
1985	244 6066	6097	6125	6156	6186	6217	6247	6278	6309	6339	6370	6400
1986	6431	6462	6490	6521	6551	6582	6612	6643	6674	6704	6735	6765
1987	6796	6827	6855	6886	6916	6947	6977	7008	7039	7069	7100	7130
1988	7161	7192	7221	7252	7282	7313	7343	7374	7405	7435	7466	7496
1989	7527	7558	7586	7617	7647	7678	7708	7739	7770	7800	7831	7861
1990	244 7892	7923	7951	7982	8012	8043	8073	8104	8135	8165	8196	8226
1991	8257	8288	8316	8347	8377	8408	8438	8469	8500	8530	8561	8591
1992	8622	8653	8682	8713	8743	8774	8804	8835	8866	8896	8927	8957
1993	8988	9019	9047	9078	9108	9139	9169	9200	9231	9261	9292	9322
1994	9353	9384	9412	9443	9473	9504	9534	9565	9596	9626	9657	9687
1995	244 9718	9749	9777	9808	9838	9869	9899	9930	9961	9991	*0022	*0052
1996	245 0083	0114	0143	0174	0204	0235	0265	0296	0327	0357	0388	0418
1997	0449	0480	0508	0539	0569	0600	0630	0661	0692	0722	0753	0783
1998	0814	0845	0873	0904	0934	0965	0995	1026	1057	1087	1118	1148
1999	1179	1210	1238	1269	1299	1330	1360	1391	1422	1452	1483	1513
2000	245 1544	1575	1604	1635	1665	1696	1726	1757	1788	1818	1849	1879

TABLE II
POLE STAR TABLE, 1967

L.S.T.	0 ^h		1 ^h		2 ^h		3 ^h		4 ^h		5 ^h	
	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀	a ₀	b ₀
m	'	'	'	'	'	'	'	'	'	'	'	'
0	-45.9	+27.0	-51.3	+14.0	-53.1	0.0	-51.3	-14.0	-45.9	-27.0	-37.3	-38.0
3	46.2	26.4	51.4	13.3	53.1	-0.7	51.1	14.7	45.5	27.6	36.8	38.5
6	46.6	25.7	51.6	12.6	53.1	1.4	50.9	15.4	45.1	28.2	36.3	39.0
9	46.9	25.1	51.8	11.9	53.1	2.1	50.7	16.0	44.8	28.8	35.8	39.5
12	47.2	24.5	51.9	11.2	53.0	2.8	50.5	16.7	44.4	29.4	35.3	39.9
15	-47.5	+23.9	-52.1	+10.5	-53.0	-3.5	-50.2	-17.4	-44.0	-30.0	-34.7	-40.4
18	47.8	23.2	52.2	9.9	52.9	4.2	50.0	18.0	43.6	30.5	34.2	40.9
21	48.1	22.6	52.3	9.2	52.9	4.9	49.8	18.7	43.2	31.1	33.7	41.3
24	48.4	22.0	52.4	8.5	52.8	5.7	49.5	19.4	42.8	31.7	33.1	41.7
27	48.7	21.3	52.5	7.8	52.7	6.4	49.3	20.0	42.4	32.2	32.6	42.2
30	-49.0	+20.7	-52.6	+7.1	-52.6	-7.1	-49.0	-20.7	-42.0	-32.8	-32.0	-42.6
33	49.3	20.0	52.7	6.4	52.5	7.8	48.7	21.3	41.5	33.4	31.5	43.0
36	49.5	19.4	52.8	5.7	52.4	8.5	48.4	22.0	41.1	33.9	30.9	43.4
39	49.8	18.7	52.9	4.9	52.3	9.2	48.1	22.6	40.6	34.4	30.3	43.8
42	50.0	18.0	52.9	4.2	52.2	9.9	47.8	23.2	40.2	35.0	29.7	44.2
45	-50.2	+17.4	-53.0	+3.5	-52.1	-10.5	-47.5	-23.9	-39.7	-35.5	-29.2	-44.6
48	50.5	16.7	53.0	2.8	51.9	11.2	47.2	24.5	39.2	36.0	28.6	45.0
51	50.7	16.0	53.1	2.1	51.8	11.9	46.9	25.1	38.8	36.5	28.0	45.3
54	50.9	15.4	53.1	1.4	51.6	12.6	46.6	25.7	38.3	37.0	27.4	45.7
57	51.1	14.7	53.1	+0.7	51.4	13.3	46.2	26.4	37.8	37.5	26.8	46.1
60	-51.3	+14.0	-53.1	0.0	-51.3	-14.0	-45.9	-27.0	-37.3	-38.0	-26.2	-46.4
Lat.	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁	a ₁	b ₁
°	'	'	'	'	'	'	'	'	'	'	'	'
0	-1	-3	.0	-1	.0	+1	-1	+3	-2	+5	-3	+5
10	-1	-3	.0	-1	.0	+1	-1	+3	-2	+4	-3	+4
20	.0	-2	.0	-1	.0	+1	.0	+2	-1	+3	-2	+3
30	.0	-2	.0	-1	.0	+1	.0	+2	-1	+2	-2	+2
40	.0	-1	.0	.0	.0	.0	.0	+1	-1	+1	-1	+1
45	.0	-1	.0	.0	.0	.0	.0	+1	.0	+1	.0	+1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+1	.0	.0	.0	.0	.0	-1	.0	-1	+1	-1
60	.0	+2	.0	+1	.0	-1	.0	-2	+1	-2	+1	-2
62	.0	+2	.0	+1	.0	-1	.0	-2	+1	-3	+2	-3
64	+1	+2	.0	+1	.0	-1	+1	-2	+1	-3	+2	-3
66	+1	+3	.0	+1	.0	-1	+1	-3	+2	-4	+3	-4
Month	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂	a ₂	b ₂
	'	'	'	'	'	'	'	'	'	'	'	'
Jan.	+2	+1	+2	+1	+1	+1	+1	+2	.0	+2	.0	+2
Feb.	+1	-1	+1	.0	+1	.0	+1	.0	+1	+1	+1	+1
Mar.	.0	-1	.0	-1	+1	-1	+1	-1	+1	-1	+1	-1
Apr.	-2	-1	-1	-2	-1	-2	.0	-2	.0	-2	+1	-2
May	-3	.0	-2	-1	-2	-2	-2	-2	-1	-3	.0	-3
June	-3	+1	-3	.0	-3	-1	-3	-2	-2	-2	-2	-3
July	-3	+3	-3	+2	-4	+1	-4	.0	-4	-1	-3	-2
Aug.	-1	+4	-2	+3	-3	+3	-4	+2	-4	+1	-4	.0
Sept.	.0	+5	-1	+4	-2	+4	-3	+3	-4	+2	-4	+1
Oct.	+2	+5	+1	+5	.0	+5	-2	+5	-3	+4	-4	+3
Nov.	+4	+4	+3	+5	+2	+5	.0	+6	-1	+5	-3	+5
Dec.	+5	+3	+4	+4	+3	+5	+2	+6	.0	+6	-1	+6

Latitude of observer is sum of corrected observed altitude of Polaris and (a₀+a₁+a₂).
Azimuth of Polaris is product of (b₀+b₁+b₂) by secant of latitude.

TABLE II
POLE STAR TABLE, 1967

L.S.T.	6 ^h		7 ^h		8 ^h		9 ^h		10 ^h		11 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m	'	'	'	'	'	'	'	'	'	'	'	'
0	-26.2	-46.4	-13.3	-51.5	+ 0.5	-53.1	+14.2	-51.1	+26.9	-45.6	+37.8	-37.1
3	25.6	46.7	12.6	51.7	1.2	53.1	14.9	50.9	27.5	45.2	38.3	36.6
6	25.0	47.1	11.9	51.9	1.9	53.1	15.5	50.6	28.1	44.8	38.7	36.1
9	24.3	47.4	11.3	52.0	2.6	53.0	16.2	50.4	28.7	44.5	39.2	35.6
12	23.7	47.7	10.6	52.1	3.3	53.0	16.9	50.2	29.3	44.1	39.7	35.0
15	-23.1	-48.0	- 9.9	-52.3	+ 4.0	-52.9	+17.5	-50.0	+29.8	-43.7	+40.1	-34.5
18	22.5	48.3	9.2	52.4	4.7	52.9	18.2	49.7	30.4	43.3	40.6	34.0
21	21.8	48.6	8.5	52.5	5.3	52.8	18.8	49.5	31.0	42.9	41.0	33.5
24	21.2	48.9	7.8	52.6	6.0	52.7	19.5	49.2	31.5	42.5	41.5	32.9
27	20.5	49.1	7.1	52.7	6.7	52.6	20.1	49.0	32.1	42.1	41.9	32.4
30	-19.9	-49.4	- 6.5	-52.8	+ 7.4	-52.5	+20.7	-48.7	+32.6	-41.7	+42.3	-31.9
33	19.3	49.7	5.8	52.8	8.1	52.4	21.4	48.4	33.2	41.2	42.7	31.3
36	18.6	49.9	5.1	52.9	8.8	52.3	22.0	48.1	33.7	40.8	43.1	30.7
39	17.9	50.1	4.4	53.0	9.5	52.2	22.6	47.8	34.2	40.3	43.5	30.2
42	17.3	50.4	3.7	53.0	10.1	52.0	23.3	47.5	34.8	39.9	43.9	29.6
45	-16.6	-50.6	- 3.0	-53.0	+10.8	-51.9	+23.9	-47.2	+35.3	-39.4	+44.3	-29.0
48	16.0	50.8	2.3	53.1	11.5	51.7	24.5	46.9	35.8	39.0	44.7	28.5
51	15.3	51.0	1.6	53.1	12.2	51.6	25.1	46.6	36.3	38.5	45.0	27.9
54	14.6	51.2	0.9	53.1	12.9	51.4	25.7	46.3	36.8	38.0	45.4	27.3
57	14.0	51.4	- 0.2	53.1	13.5	51.2	26.3	45.9	37.3	37.5	45.8	26.7
60	-13.3	-51.5	+ 0.5	-53.1	+14.2	-51.1	+26.9	-45.6	+37.8	-37.1	+46.1	-26.1
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°	'	'	'	'	'	'	'	'	'	'	'	'
0	- .4	+ .3	- .5	+ .1	- .5	- .1	- .4	- .3	- .3	- .5	- .2	- .5
10	- .4	+ .3	- .4	+ .1	- .4	- .1	- .4	- .3	- .3	- .4	- .2	- .4
20	- .3	+ .2	- .3	+ .1	- .3	- .1	- .3	- .2	- .2	- .3	- .1	- .3
30	- .2	+ .2	- .2	+ .1	- .2	- .1	- .2	- .2	- .2	- .2	- .1	- .2
40	- .1	+ .1	- .1	. 0	- .1	. 0	- .1	- .1	- .1	- .1	- .1	- .1
45	- .1	+ .1	- .1	. 0	- .1	. 0	- .1	- .1	. 0	- .1	. 0	- .1
50	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0	. 0
55	+ .1	- .1	+ .1	. 0	+ .1	. 0	+ .1	+ .1	+ .1	+ .1	. 0	+ .1
60	+ .2	- .2	+ .2	- .1	+ .2	+ .1	+ .2	+ .2	+ .1	+ .2	+ .1	+ .2
62	+ .2	- .2	+ .3	- .1	+ .3	+ .1	+ .2	+ .2	+ .2	+ .3	+ .1	+ .3
64	+ .3	- .2	+ .3	- .1	+ .3	+ .1	+ .3	+ .2	+ .2	+ .3	+ .1	+ .3
66	+ .4	- .3	+ .4	- .1	+ .4	+ .1	+ .4	+ .3	+ .3	+ .4	+ .2	+ .4
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
	'	'	'	'	'	'	'	'	'	'	'	'
Jan.	- .1	+ .2	- .1	+ .2	- .1	+ .1	- .2	+ .1	- .2	. 0	- .2	. 0
Feb.	+ .1	+ .1	. 0	+ .1	. 0	+ .1	. 0	+ .1	- .1	+ .1	- .1	+ .1
Mar.	+ .1	. 0	+ .1	. 0	+ .1	+ .1	+ .1	+ .1	+ .1	+ .1	+ .1	+ .1
Apr.	+ .1	- .2	+ .2	- .1	+ .2	- .1	+ .2	. 0	+ .2	. 0	+ .2	+ .1
May	. 0	- .3	+ .1	- .2	+ .2	- .2	+ .2	- .2	+ .3	- .1	+ .3	. 0
June	- .1	- .3	. 0	- .3	+ .1	- .3	+ .2	- .3	+ .2	- .2	+ .3	- .2
July	- .3	- .3	- .2	- .3	- .1	- .4	. 0	- .4	+ .1	- .4	+ .2	- .3
Aug.	- .4	- .1	- .3	- .2	- .3	- .3	- .2	- .4	- .1	- .4	. 0	- .4
Sept.	- .5	. 0	- .4	- .1	- .4	- .2	- .3	- .3	- .2	- .4	- .1	- .4
Oct.	- .5	+ .2	- .5	+ .1	- .5	. 0	- .5	- .2	- .4	- .3	- .3	- .4
Nov.	- .4	+ .4	- .5	+ .3	- .5	+ .2	- .6	. 0	- .5	- .1	- .5	- .3
Dec.	- .3	+ .5	- .4	+ .4	- .5	+ .3	- .6	+ .2	- .6	. 0	- .6	- .1

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

TABLE II
POLE STAR TABLE, 1967

L.S.T.	12 ^h		13 ^h		14 ^h		15 ^h		16 ^h		17 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m	'	'	'	'	'	'	'	'	'	'	'	'
0	+46.1	-26.1	+51.3	-13.5	+53.1	0.0	+51.3	+13.5	+46.1	+26.1	+37.8	+37.1
3	46.4	25.5	51.5	12.8	53.1	+ 0.7	51.1	14.2	45.8	26.7	37.3	37.5
6	46.8	24.9	51.7	12.2	53.1	1.4	50.9	14.8	45.4	27.3	36.8	38.0
9	47.1	24.3	51.8	11.5	53.1	2.0	50.8	15.5	45.0	27.9	36.3	38.5
12	47.4	23.7	52.0	10.8	53.0	2.7	50.5	16.1	44.7	28.5	35.8	39.0
15	+47.7	-23.1	+52.1	-10.2	+53.0	+ 3.4	+50.3	+16.8	+44.3	+29.0	+35.3	+39.4
18	48.0	22.5	52.2	9.5	52.9	4.1	50.1	17.4	43.9	29.6	34.8	39.9
21	48.3	21.9	52.3	8.8	52.9	4.8	49.9	18.1	43.5	30.2	34.2	40.3
24	48.6	21.2	52.5	8.2	52.8	5.4	49.6	18.7	43.1	30.7	33.7	40.8
27	48.9	20.6	52.6	7.5	52.7	6.1	49.4	19.3	42.7	31.3	33.2	41.2
30	+49.1	-20.0	+52.7	- 6.8	+52.7	+ 6.8	+49.1	+20.0	+42.3	+31.9	+32.6	+41.7
33	49.4	19.3	52.7	6.1	52.6	7.5	48.9	20.6	41.9	32.4	32.1	42.1
36	49.6	18.7	52.8	5.4	52.5	8.2	48.6	21.2	41.5	32.9	31.5	42.5
39	49.9	18.1	52.9	4.8	52.3	8.8	48.3	21.9	41.0	33.5	31.0	42.9
42	50.1	17.4	52.9	4.1	52.2	9.5	48.0	22.5	40.6	34.0	30.4	43.3
45	+50.3	-16.8	+53.0	- 3.4	+52.1	+10.2	+47.7	+23.1	+40.1	+34.5	+29.8	+43.7
48	50.5	16.1	53.0	2.7	52.0	10.8	47.4	23.7	39.7	35.0	29.3	44.1
51	50.8	15.5	53.1	2.0	51.8	11.5	47.1	24.3	39.2	35.6	28.7	44.5
54	50.9	14.8	53.1	1.4	51.7	12.2	46.8	24.9	38.7	36.1	28.1	44.8
57	51.1	14.2	53.1	- 0.7	51.5	12.8	46.4	25.5	38.3	36.6	27.5	45.2
60	+51.3	-13.5	+53.1	0.0	+51.3	+13.5	+46.1	+26.1	+37.8	+37.1	+26.9	+45.6
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°	'	'	'	'	'	'	'	'	'	'	'	'
0	-1	-3	.0	-1	.0	+1	-1	+3	-2	+5	-3	+5
10	-1	-3	.0	-1	.0	+1	-1	+3	-2	+4	-3	+4
20	.0	-2	.0	-1	.0	+1	.0	+2	-1	+3	-2	+3
30	.0	-2	.0	-1	.0	+1	.0	+2	-1	+2	-2	+2
40	.0	-1	.0	.0	.0	.0	.0	+1	-1	+1	-1	+1
45	.0	-1	.0	.0	.0	.0	.0	+1	.0	+1	.0	+1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	.0	+1	.0	.0	.0	.0	.0	-1	.0	-1	+1	-1
60	.0	+2	.0	+1	.0	-1	.0	-2	+1	-2	+1	-2
62	.0	+2	.0	+1	.0	-1	.0	-2	+1	-3	+2	-3
64	+1	+2	.0	+1	.0	-1	+1	-2	+1	-3	+2	-3
66	+1	+3	.0	+1	.0	-1	+1	-3	+2	-4	+3	-4
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
	'	'	'	'	'	'	'	'	'	'	'	'
Jan.	-2	-1	-2	-1	-1	-1	-1	-2	.0	-2	.0	-2
Feb.	-1	+1	-1	.0	-1	.0	-1	.0	-1	-1	-1	-1
Mar.	.0	+1	.0	+1	-1	+1	-1	+1	-1	+1	-1	+1
Apr.	+2	+1	+1	+2	+1	+2	.0	+2	.0	+2	-1	+2
May	+3	.0	+2	+1	+2	+2	+2	+2	+1	+3	.0	+3
June	+3	-1	+3	.0	+3	+1	+3	+2	+2	+2	+2	+3
July	+3	-3	+3	-2	+4	-1	+4	.0	+4	+1	+3	+2
Aug.	+1	-4	+2	-3	+3	-3	+4	-2	+4	-1	+4	.0
Sept.	.0	-5	+1	-4	+2	-4	+3	-3	+4	-2	+4	-1
Oct.	-2	-5	-1	-5	.0	-5	+2	-5	+3	-4	+4	-3
Nov.	-4	-4	-3	-5	-2	-5	.0	-6	+1	-5	+3	-5
Dec.	-5	-3	-4	-4	-3	-5	-2	-6	.0	-6	+1	-6

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

TABLE II
POLE STAR TABLE, 1967

L.S.T.	18 ^h		19 ^h		20 ^h		21 ^h		22 ^h		23 ^h	
	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀	<i>a</i> ₀	<i>b</i> ₀
m												
0	+26.9	+45.6	+14.2	+51.1	+ 0.5	+53.1	-13.3	+51.5	-26.2	+46.4	-37.3	+38.0
3	26.3	45.9	13.5	51.2	- 0.2	53.1	14.0	51.4	26.8	46.1	37.8	37.5
6	25.7	46.3	12.9	51.4	0.9	53.1	14.6	51.2	27.4	45.7	38.3	37.0
9	25.1	46.6	12.2	51.6	1.6	53.1	15.3	51.0	28.0	45.3	38.8	36.5
12	24.5	46.9	11.5	51.7	2.3	53.1	16.0	50.8	28.6	45.0	39.2	36.0
15	+23.9	+47.2	+10.8	+51.9	- 3.0	+53.0	-16.6	+50.6	-29.2	+44.6	-39.7	+35.5
18	23.3	47.5	10.1	52.0	3.7	53.0	17.3	50.4	29.7	44.2	40.2	35.0
21	22.6	47.8	9.5	52.2	4.4	53.0	17.9	50.1	30.3	43.8	40.6	34.4
24	22.0	48.1	8.8	52.3	5.1	52.9	18.6	49.9	30.9	43.4	41.1	33.9
27	21.4	48.4	8.1	52.4	5.8	52.8	19.3	49.7	31.5	43.0	41.5	33.4
30	+20.7	+48.7	+ 7.4	+52.5	- 6.5	+52.8	-19.9	+49.4	-32.0	+42.6	-42.0	+32.8
33	20.1	49.0	6.7	52.6	7.1	52.7	20.5	49.1	32.6	42.2	42.4	32.2
36	19.5	49.2	6.0	52.7	7.8	52.6	21.2	48.9	33.1	41.7	42.8	31.7
39	18.8	49.5	5.3	52.8	8.5	52.5	21.8	48.6	33.7	41.3	43.2	31.1
42	18.2	49.7	4.7	52.9	9.2	52.4	22.5	48.3	34.2	40.9	43.6	30.5
45	+17.5	+50.0	+ 4.0	+52.9	- 9.9	+52.3	-23.1	+48.0	-34.7	+40.4	-44.0	+30.0
48	16.9	50.2	3.3	53.0	10.6	52.1	23.7	47.7	35.3	39.9	44.4	29.4
51	16.2	50.4	2.6	53.0	11.3	52.0	24.3	47.4	35.8	39.5	44.8	28.8
54	15.5	50.6	1.9	53.1	11.9	51.9	25.0	47.1	36.3	39.0	45.1	28.2
57	14.9	50.9	1.2	53.1	12.6	51.7	25.6	46.7	36.8	38.5	45.5	27.6
60	+14.2	+51.1	+ 0.5	+53.1	-13.3	+51.5	-26.2	+46.4	-37.3	+38.0	-45.9	+27.0
Lat.	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁	<i>a</i> ₁	<i>b</i> ₁
°												
0	- .4	+ .3	- .5	+ .1	- .5	- .1	- .4	- .3	- .3	- .5	- .2	- .5
10	- .4	+ .3	- .4	+ .1	- .4	- .1	- .4	- .3	- .3	- .4	- .2	- .4
20	- .3	+ .2	- .3	+ .1	- .3	- .1	- .3	- .2	- .2	- .3	- .1	- .3
30	- .2	+ .2	- .2	+ .1	- .2	- .1	- .2	- .2	- .2	- .2	- .1	- .2
40	- .1	+ .1	- .1	.0	- .1	.0	- .1	- .1	- .1	- .1	- .1	- .1
45	- .1	+ .1	- .1	.0	- .1	.0	- .1	- .1	.0	- .1	.0	- .1
50	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
55	+ .1	- .1	+ .1	.0	+ .1	.0	+ .1	+ .1	+ .1	+ .1	.0	+ .1
60	+ .2	- .2	+ .2	- .1	+ .2	+ .1	+ .2	+ .2	+ .1	+ .2	+ .1	+ .2
62	+ .2	- .2	+ .3	- .1	+ .3	+ .1	+ .2	+ .2	+ .2	+ .3	+ .1	+ .3
64	+ .3	- .2	+ .3	- .1	+ .3	+ .1	+ .3	+ .2	+ .2	+ .3	+ .1	+ .3
66	+ .4	- .3	+ .4	- .1	+ .4	+ .1	+ .4	+ .3	+ .3	+ .4	+ .2	+ .4
Month	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂	<i>a</i> ₂	<i>b</i> ₂
Jan.	+ .1	- .2	+ .1	- .2	+ .1	- .1	+ .2	- .1	+ .2	.0	+ .2	.0
Feb.	- .1	- .1	.0	- .1	.0	- .1	.0	- .1	+ .1	- .1	+ .1	- .1
Mar.	- .1	.0	- .1	.0	- .1	- .1	- .1	- .1	- .1	- .1	- .1	- .1
Apr.	- .1	+ .2	- .2	+ .1	- .2	+ .1	- .2	.0	- .2	.0	- .2	- .1
May	.0	+ .3	- .1	+ .2	- .2	+ .2	- .2	+ .2	- .3	+ .1	- .3	.0
June	+ .1	+ .3	.0	+ .3	- .1	+ .3	- .2	+ .3	- .2	+ .2	- .3	+ .2
July	+ .3	+ .3	+ .2	+ .3	+ .1	+ .4	.0	+ .4	- .1	+ .4	- .2	+ .3
Aug.	+ .4	+ .1	+ .3	+ .2	+ .3	+ .3	+ .2	+ .4	+ .1	+ .4	.0	+ .4
Sept.	+ .5	.0	+ .4	+ .1	+ .4	+ .2	+ .3	+ .3	+ .2	+ .4	+ .1	+ .4
Oct.	+ .5	- .2	+ .5	- .1	+ .5	.0	+ .5	+ .2	+ .4	+ .3	+ .3	+ .4
Nov.	+ .4	- .4	+ .5	- .3	+ .5	- .2	+ .6	.0	+ .5	+ .1	+ .5	+ .3
Dec.	+ .3	- .5	+ .4	- .4	+ .5	- .3	+ .6	- .2	+ .6	.0	+ .6	+ .1

Latitude of observer is sum of corrected observed altitude of Polaris and (*a*₀+*a*₁+*a*₂).
Azimuth of Polaris is product of (*b*₀+*b*₁+*b*₂) by secant of latitude.

CONSTANTS FOR THE REDUCTION OF THE MEAN PLACES OF STARS
FROM THE EQUINOX OF t_0 TO THAT OF $t=1967.0$

t_0	ζ_0	z	θ	t_0	M	N	
	' "	' "	' "		s	s	"
1755	+81 22.25	+81 25.81	+70 50.24	1755	+651.18	+283.38	+4250.6
1760	79 27.21	79 30.60	69 09.97	1760	635.83	276.69	4150.3
1765	77 32.16	77 35.40	67 29.70	1765	620.48	270.00	4050.0
1770	75 37.11	75 40.19	65 49.44	1770	605.13	263.32	3949.8
1775	73 42.05	73 44.97	64 09.17	1775	589.78	256.63	3849.5
1780	+71 46.99	+71 49.76	+62 28.91	1780	+574.43	+249.95	+3749.2
1785	69 51.93	69 54.55	60 48.64	1785	559.08	243.26	3648.9
1790	67 56.85	67 59.33	59 08.38	1790	543.73	236.57	3548.6
1795	66 01.78	66 04.12	57 28.12	1795	528.38	229.89	3448.3
1800	64 06.69	64 08.90	55 47.86	1800	513.03	223.20	3348.1
1805	+62 11.61	+62 13.69	+54 07.60	1805	+497.68	+216.52	+3247.8
1810	60 16.52	60 18.47	52 27.35	1810	482.32	209.83	3147.5
1815	58 21.42	58 23.25	50 47.09	1815	466.97	203.15	3047.2
1820	56 26.32	56 28.03	49 06.83	1820	451.62	196.46	2947.0
1825	54 31.21	54 32.81	47 26.58	1825	436.26	189.78	2846.7
1830	+52 36.10	+52 37.58	+45 46.33	1830	+420.91	+183.10	+2746.4
1835	50 40.98	50 42.36	44 06.07	1835	405.55	176.41	2646.2
1840	48 45.86	48 47.14	42 25.82	1840	390.19	169.73	2545.9
1845	46 50.73	46 51.91	40 45.57	1845	374.84	163.04	2445.7
1850	44 55.60	44 56.68	39 05.33	1850	359.48	156.36	2345.4
1855	+43 00.46	+43 01.45	+37 25.08	1855	+344.12	+149.68	+2245.1
1860	41 05.32	41 06.22	35 44.84	1860	328.77	142.99	2144.9
1865	39 10.17	39 10.99	34 04.59	1865	313.41	136.31	2044.6
1870	37 15.02	37 15.76	32 24.35	1870	298.05	129.63	1944.4
1875	35 19.86	35 20.53	30 44.11	1875	282.69	122.94	1844.1
1880	+33 24.69	+33 25.29	+29 03.87	1880	+267.33	+116.26	+1743.9
1885	31 29.53	31 30.06	27 23.63	1885	251.97	109.58	1643.7
1890	29 34.35	29 34.82	25 43.40	1890	236.61	102.89	1543.4
1895	27 39.17	27 39.58	24 03.17	1895	221.25	96.21	1443.2
1900	25 43.99	25 44.34	22 22.93	1900	205.89	89.53	1342.9
1905	+23 48.80	+23 49.10	+20 42.70	1905	+190.53	+ 82.85	+1242.7
1910	21 53.60	21 53.86	19 02.47	1910	175.16	76.17	1142.5
1915	19 58.40	19 58.62	17 22.25	1915	159.80	69.48	1042.3
1920	18 03.20	18 03.37	15 42.02	1920	144.44	62.80	942.0
1925	16 07.99	16 08.13	14 01.80	1925	129.07	56.12	841.8
1930	+14 12.77	+14 12.88	+12 21.58	1930	+113.71	+ 49.44	+ 741.6
1935	12 17.55	12 17.63	10 41.36	1935	98.35	42.76	641.4
1940	10 22.32	10 22.38	9 01.14	1940	82.98	36.08	541.1
1945	8 27.09	8 27.13	7 20.92	1945	67.61	29.39	440.9
1950	6 31.85	6 31.87	5 40.71	1950	52.25	22.71	340.7
1955	+ 4 36.61	+ 4 36.62	+ 4 00.50	1955	+ 36.88	+ 16.03	+ 240.5
1960	2 41.36	2 41.36	2 20.29	1960	21.51	9.35	140.3
1965	+ 0 46.10	+ 0 46.10	+ 0 40.08	1965	+ 6.15	+ 2.67	+ 40.1

APPROXIMATE REDUCTION FROM THE STANDARD EQUINOX OF
1950.0 TO THE TRUE EQUINOX, 1967

δ	$4 \tan \delta$	Date	f	g	G	Date	f	g	G
$^{\circ}$			$^{\circ}$	$'$	$^{\text{h}}$ $^{\text{m}}$		$^{\circ}$	$'$	$^{\text{h}}$ $^{\text{m}}$
0	0.00	Jan. 0	+51.6	5.61	23 56	June 29	+53.2	5.78	23 56
1	0.07	10	51.7	5.62	23 56	July 9*	53.3	5.80	23 56
2	0.14	20	51.8	5.63	23 56	19	53.4	5.81	23 56
3	0.21	30*	51.9	5.64	23 56	29	53.5	5.82	23 55
4	0.28	Feb. 9	52.0	5.65	23 56	Aug. 8	53.6	5.83	23 55
5	0.35	19	+52.0	5.66	23 56	18*	+53.7	5.84	23 55
6	0.42	Mar. 1	52.1	5.67	23 55	28	53.8	5.85	23 55
7	0.49	11*	52.2	5.68	23 55	Sept. 7	53.9	5.85	23 55
8	0.56	21	52.3	5.68	23 55	17	53.9	5.86	23 55
9	0.63	31	52.3	5.69	23 55	27*	54.0	5.87	23 55
10	0.71	Apr. 10	+52.4	5.70	23 55	Oct. 7	+54.0	5.88	23 55
11	0.78	20*†	52.5	5.71	23 55	17	54.1	5.88	23 55
12	0.85	30	52.6	5.72	23 56	27	54.2	5.89	23 55
13	0.92	May 10	52.6	5.72	23 56	Nov. 6*	54.3	5.90	23 55
14	1.00	20	52.7	5.73	23 56	16	54.4	5.91	23 55
15	1.07	30*	+52.9	5.75	23 56	26	+54.5	5.92	23 55
16	1.15	June 9	53.0	5.76	23 56	Dec. 6	54.6	5.94	23 55
17	1.22	19	53.1	5.77	23 56	16*	54.7	5.95	23 56
18	1.30	29	53.2	5.78	23 56	26	54.8	5.96	23 55
19	1.38	July 9*	+53.3	5.80	23 56	36	+55.0	5.98	23 55
20	1.46	*40-day ephemeris date							
21	1.54	†400-day date for osculation epoch							
22	1.62								
23	1.70								
24	1.78								
$4 \tan \delta$									
	δ	0'	10'	20'	30'	40'	50'	60'	
25	1.87	45	4.00	4.02	4.05	4.07	4.09	4.12	4.14
26	1.95	46	4.14	4.17	4.19	4.22	4.24	4.26	4.29
27	2.04	47	4.29	4.31	4.34	4.37	4.39	4.42	4.44
28	2.13	48	4.44	4.47	4.49	4.52	4.55	4.57	4.60
29	2.22	49	4.60	4.63	4.66	4.68	4.71	4.74	4.77
30	2.31	50	4.77	4.80	4.82	4.85	4.88	4.91	4.94
31	2.40	51	4.94	4.97	5.00	5.03	5.06	5.09	5.12
32	2.50	52	5.12	5.15	5.18	5.21	5.24	5.28	5.31
33	2.60	53	5.31	5.34	5.37	5.41	5.44	5.47	5.51
34	2.70	54	5.51	5.54	5.57	5.61	5.64	5.68	5.71
35	2.80	55	5.71	5.75	5.78	5.82	5.86	5.89	5.93
36	2.91	56	5.93	5.97	6.01	6.04	6.08	6.12	6.16
37	3.01	57	6.16	6.20	6.24	6.28	6.32	6.36	6.40
38	3.13	58	6.40	6.44	6.48	6.53	6.57	6.61	6.66
39	3.24	59	6.66	6.70	6.75	6.79	6.84	6.88	6.93
40	3.36	60	6.93	6.97	7.02	7.07	7.12	7.17	7.22
41	3.48	61	7.22	7.27	7.32	7.37	7.42	7.47	7.52
42	3.60	62	7.52	7.58	7.63	7.68	7.74	7.79	7.85
43	3.73	63	7.85	7.91	7.96	8.02	8.08	8.14	8.20
44	3.86	64	8.20	8.26	8.32	8.39	8.45	8.51	8.58
45	4.00	65	8.58	8.64	8.71	8.78	8.85	8.91	8.98

$$\alpha_{\text{Date}} = \alpha_{1950} + f + g \sin (G + \alpha_{1950}) \tan \delta_{1950}$$

$$\delta_{\text{Date}} = \delta_{1950} + g \cos (G + \alpha_{1950})$$

In the formula for α , the last term is to be expressed in seconds of time by multiplying g in minutes of arc by 4, where the factor 4 is applied by using the tabular value of $4 \tan \delta$.

DIFFERENTIAL ABERRATION

The correction for differential stellar aberration to be *added* to the observed differences $\Delta\alpha$ and $\Delta\delta$ of the right ascension and declination of an object relative to a comparison star, measured in the sense object *minus* star in units of $1''$ and $1'$ respectively, to obtain the true differences, is:

In right ascension, $a\Delta\alpha + b\frac{\Delta\delta}{10}$ in units of $0.001''$,

In declination, $c\Delta\alpha + d\frac{\Delta\delta}{10}$ in units of $0''.01$,

where a, b, c, d , are obtained from the table below with arguments $H+\alpha$ and δ , and may in general be taken out without interpolation; for the signs, see opposite page.

Date	H	Date	H	Date	H	Date	H	Date	H	Date	H
Dec. 26	23.5 ^b	Feb. 25	19.5 ^b	Apr. 22	15.5 ^b	June 26	11.5 ^b	Aug. 29	7.5 ^b	Oct. 25	3.5 ^b
Jan. 3	23.0	Mar. 4	19.0	29	15.0	July 5	11.0	6	7.0	Nov. 2	3.0
11	22.5	11	18.5	7	14.5	13	10.5	13	6.5	9	2.5
19	22.0	17	18.0	15	14.0	21	10.0	20	6.0	17	2.0
26	21.5	24	17.5	23	13.5	29	9.5	27	5.5	24	1.5
Feb. 3	21.0	31	17.0	31	13.0	Aug. 6	9.0	Oct. 4	5.0	Dec. 2	1.0
10	20.5	Apr. 7	16.5	June 9	12.5	14	8.5	11	4.5	10	0.5
17	20.0	15	16.0	17	12.0	22	8.0	18	4.0	18	0.0
25		22		26		29		25		26	

In critical cases ascend.

δ	0°				10°				20°				30°				40°				$H+\alpha$
$H+\alpha$	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	$H+\alpha$
0 ^b	-6	0	0	-6	-6	0	0	-6	-6	0	0	-5	-7	0	0	-5	-7	0	0	-4	24 ^b
1	6	0	0	6	6	0	0	5	6	0	1	5	6	1	1	5	7	1	1	4	23
2	5	0	0	5	5	0	1	5	5	1	1	5	6	1	2	4	6	2	3	4	22
3	4	0	0	4	4	0	1	4	4	1	2	4	5	2	3	3	5	3	4	3	21
4	3	0	0	3	3	1	1	3	3	1	3	3	3	2	4	2	4	4	5	2	20
5	-1	0	0	-1	-1	1	1	-1	-2	1	3	-1	-2	2	4	-1	-2	4	5	-1	19
6	0	0	0	0	0	1	1	0	0	1	3	0	0	3	4	0	0	4	5	0	18
7	+1	0	0	+1	+1	1	1	+1	+2	1	3	+1	+2	2	4	+1	+2	4	5	+1	17
8	3	0	0	3	3	1	1	3	3	1	3	3	3	2	4	2	4	4	5	2	16
9	4	0	0	4	4	0	1	4	4	1	2	4	5	2	3	3	5	3	4	3	15
10	5	0	0	5	5	0	1	5	5	1	1	5	6	1	2	4	6	2	3	4	14
11	6	0	0	6	6	0	0	5	6	0	1	5	6	1	1	5	7	1	1	4	13
12	+6	0	0	+6	+6	0	0	+6	+6	0	0	+5	+7	0	0	+5	+7	0	0	+4	12
						+	-			+	-			+	-			+	-		
δ	45°				50°				55°				60°				65°				δ
$H+\alpha$	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	$H+\alpha$
0 ^b	-8	0	0	-4	-9	0	0	-4	-10	0	0	-3	-11	0	0	-3	-13	0	0	-2	24 ^b
1	8	1	2	4	9	2	2	4	10	2	2	3	11	3	2	3	13	5	2	2	23
2	7	3	3	3	8	4	3	3	9	5	4	3	10	7	4	2	12	10	4	2	22
3	6	4	4	3	6	5	5	3	7	7	5	2	8	9	5	2	10	14	5	2	21
4	4	5	5	2	4	6	6	2	5	8	6	2	6	11	6	1	7	17	7	1	20
5	-2	5	6	-1	-2	7	6	-1	-3	9	7	-1	-3	13	7	-1	-3	19	7	-1	19
6	0	5	6	0	0	7	7	0	0	9	7	0	0	13	7	0	0	19	8	0	18
7	+2	5	6	+1	+2	7	6	+1	+3	9	7	+1	+3	13	7	+1	+3	19	7	+1	17
8	4	5	5	2	4	6	6	2	5	8	6	2	6	11	6	1	7	17	7	1	16
9	6	4	4	3	6	5	5	3	7	7	5	2	8	9	5	2	10	14	5	2	15
10	7	3	3	3	8	4	3	3	9	5	4	3	10	7	4	2	12	10	4	2	14
11	8	1	2	4	9	2	2	4	10	2	2	3	11	3	2	3	13	5	2	2	13
12	+8	0	0	+4	+9	0	0	+4	+10	0	0	+3	+11	0	0	+3	+13	0	0	+2	12
		+	-			+	-			+	-			+	-			+	-		

DIFFERENTIAL ABERRATION

For positive declinations, take the signs of b and c (which are always opposite) from the top of the column when the argument $H+\alpha$ is on the left, from the bottom when $H+\alpha$ is on the right. For negative declinations, reverse the signs of b and c .

The signs of a and d (which are always alike) are independent of the sign of δ , and also of whether $H+\alpha$ is on the left or the right.

δ	62°				64°				66°				68°				70°				δ
$H+\alpha$	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	$H+\alpha$
δ		-	+			-	+			-	+			-	+			-	+		δ
0	-12	0	0	-3	-13	0	0	-2	-14	0	0	-2	-15	0	0	-2	-17	0	0	-2	24
1	12	4	2	3	13	5	2	2	14	5	2	2	15	6	2	2	16	8	2	2	23
2	11	8	4	2	11	9	4	2	12	10	4	2	13	13	4	2	14	15	4	2	22
3	9	11	5	2	9	13	5	2	10	15	6	2	11	18	6	2	12	22	6	1	21
4	6	13	7	1	7	15	7	1	7	18	7	1	8	22	7	1	8	26	7	1	20
5	-3	15	7	-1	-3	17	7	-1	-4	20	8	-1	-4	24	8	-1	-4	29	8	-1	19
6	0	15	8	0	0	18	8	0	0	21	8	0	0	25	8	0	0	31	8	0	18
7	+3	15	7	+1	+3	17	7	+1	+4	20	8	+1	+4	24	8	+1	+4	29	8	+1	17
8	6	13	7	1	7	15	7	1	7	18	7	1	8	22	7	1	8	26	7	1	16
9	9	11	5	2	9	13	5	2	10	15	6	2	11	18	6	2	12	22	6	1	15
10	11	8	4	2	11	9	4	2	12	10	4	2	13	13	4	2	14	15	4	2	14
11	12	4	2	3	13	5	2	2	14	5	2	2	15	6	2	2	16	8	2	2	13
12	+12	0	0	+3	+13	0	0	+2	+14	0	0	+2	+15	0	0	+2	+17	0	0	+2	12
		+	-			+	-			+	-			+	-			+	-		
δ	71°				72°				73°				74°				75°				δ
δ		-	+			-	+			-	+			-	+			-	+		δ
0.0	-18	0	0	-2	-18	0	0	-2	-20	0	0	-2	-21	0	0	-2	-22	0	0	-1	24.0
0.5	17	4	1	2	18	5	1	2	19	6	1	2	21	6	1	2	22	7	1	1	23.5
1.0	17	9	2	2	18	10	2	2	19	11	2	2	20	12	2	2	21	14	2	1	23.0
1.5	16	13	3	2	17	15	3	2	18	16	3	2	19	18	3	1	20	21	3	1	22.5
2.0	15	17	4	2	16	19	4	2	17	21	4	1	18	24	4	1	19	27	4	1	22.0
2.5	14	21	5	1	15	23	5	1	15	26	5	1	16	29	5	1	17	33	5	1	21.5
3.0	-12	24	6	-1	-13	27	6	-1	-14	30	6	-1	-15	34	6	-1	-16	39	6	-1	21.0
3.5	11	27	6	1	11	30	6	1	12	34	6	1	13	38	7	1	13	43	7	1	20.5
4.0	9	29	7	1	9	33	7	1	10	37	7	1	10	42	7	1	11	48	7	1	20.0
4.5	7	31	7	-1	7	35	8	-1	8	39	8	-1	8	44	8	-1	8	51	8	-1	19.5
5.0	5	33	8	0	5	37	8	0	5	41	8	0	5	46	8	0	6	53	8	0	19.0
5.5	-2	34	8	0	-2	38	8	0	-3	42	8	0	-3	48	8	0	-3	54	8	0	18.5
6.0	0	34	8	0	0	38	8	0	0	43	8	0	0	48	8	0	0	55	8	0	18.0
6.5	+2	34	8	0	+2	38	8	0	+3	42	8	0	+3	48	8	0	+3	54	8	0	17.5
7.0	5	33	8	0	5	37	8	0	5	41	8	0	5	46	8	0	6	53	8	0	17.0
7.5	7	31	7	+1	7	35	8	+1	8	39	8	+1	8	44	8	+1	8	51	8	+1	16.5
8.0	9	29	7	1	9	33	7	1	10	37	7	1	10	42	7	1	11	48	7	1	16.0
8.5	11	27	6	1	11	30	6	1	12	34	6	1	13	38	7	1	13	43	7	1	15.5
9.0	12	24	6	1	13	27	6	1	14	30	6	1	15	34	6	1	16	39	6	1	15.0
9.5	+14	21	5	+1	+15	23	5	+1	+15	26	5	+1	+16	29	5	+1	+17	33	5	+1	14.5
10.0	15	17	4	2	16	19	4	2	17	21	4	1	18	24	4	1	19	27	4	1	14.0
10.5	16	13	3	2	17	15	3	2	18	16	3	2	19	18	3	1	20	21	3	1	13.5
11.0	17	9	2	2	18	10	2	2	19	11	2	2	20	12	2	2	21	14	2	1	13.0
11.5	17	4	1	2	18	5	1	2	19	6	1	2	21	6	1	2	22	7	1	1	12.5
12.0	+18	0	0	+2	+18	0	0	+2	+20	0	0	+2	+21	0	0	+2	+22	0	0	+1	12.0
		+	-			+	-			+	-			+	-			+	-		

DIFFERENTIAL PRECESSION AND NUTATION, 1967

The correction for differential precession and nutation to be *added* to the observed differences $\Delta\alpha$ and $\Delta\delta$ of the right ascension and declination of an object relative to a comparison star, measured in the sense object *minus* star in units of 1^m and $1'$ respectively, is:

In right ascension, $e\Delta\alpha \frac{10 \tan \delta}{15} - f\Delta\delta \frac{10 \sec^2 \delta}{225}$, units of $0''.001$;
in declination, $f\Delta\alpha$, units of $0''.01$;

where e and f are taken from the table below, with the signs given in the table when $0^\circ \leq \alpha \leq 12^\circ$, but with the opposite signs when $12^\circ \leq \alpha \leq 24^\circ$.

		Jan. 1		Apr. 1		July 1		Oct. 1		Dec. 32				δ	$\frac{10 \tan \delta}{15}$	$\frac{10 \sec^2 \delta}{225}$							
α	FOR REDUCTION TO 1950.0												α	$^{\circ}$									
h	e	f	e	f	e	f	e	f	e	f	e	f	h										
0.0	-147	- 2	-149	- 3	-151	- 3	-154	- 3	-156	- 3	12.0	0	0.00	0.04									
0.5	-146	+ 17	-148	+ 16	-150	+ 17	-153	+ 17	-155	+ 17	12.5	5	0.06	.04									
1.0	-142	+ 36	-145	+ 36	-147	+ 36	-149	+ 36	-152	+ 37	13.0	10	0.12	.05									
1.5	-137	+ 54	-139	+ 54	-141	+ 55	-143	+ 56	-146	+ 57	13.5	15	0.18	.05									
2.0	-128	+ 71	-131	+ 72	-133	+ 73	-135	+ 74	-137	+ 76	14.0	20	0.24	0.05									
2.5	-118	+ 87	-120	+ 88	-122	+ 90	-124	+ 91	-126	+ 93	14.5	25	0.31	.05									
												30	0.38	.06									
												35	0.47	.07									
3.0	-106	+102	-107	+103	-109	+105	-111	+106	-113	+108	15.0	40	0.56	0.08									
3.5	- 91	+115	- 93	+116	- 94	+118	- 96	+120	- 98	+122	15.5	41	0.58	.08									
4.0	- 76	+126	- 77	+127	- 78	+130	- 80	+131	- 81	+134	16.0	42	0.60	.08									
4.5	- 58	+135	- 60	+136	- 61	+139	- 62	+141	- 63	+143	16.5	43	0.62	.08									
5.0	- 40	+141	- 41	+143	- 42	+146	- 43	+148	- 43	+150	17.0	44	0.64	.09									
5.5	- 22	+145	- 22	+147	- 23	+150	- 23	+152	- 23	+155	17.5												
6.0	- 2	+147	- 3	+149	- 3	+151	- 3	+154	- 3	+156	18.0	45	0.67	0.09									
												46	0.69	.09									
6.5	+ 17	+146	+ 16	+148	+ 17	+150	+ 17	+153	+ 17	+155	18.5	47	0.71	.10									
7.0	+ 36	+142	+ 36	+145	+ 36	+147	+ 36	+149	+ 37	+152	19.0	48	0.74	.10									
7.5	+ 54	+137	+ 54	+139	+ 55	+141	+ 56	+143	+ 57	+146	19.5	49	0.77	.10									
8.0	+ 71	+128	+ 72	+131	+ 73	+133	+ 74	+135	+ 76	+137	20.0	50	0.79	0.11									
8.5	+ 87	+118	+ 88	+120	+ 90	+122	+ 91	+124	+ 93	+126	20.5	51	0.82	.11									
9.0	+102	+106	+103	+107	+105	+109	+106	+111	+108	+113	21.0	52	0.85	.12									
												53	0.88	.12									
9.5	+115	+ 91	+116	+ 93	+118	+ 94	+120	+ 96	+122	+ 98	21.5	54	0.92	.13									
10.0	+126	+ 76	+127	+ 77	+130	+ 78	+131	+ 80	+134	+ 81	22.0												
10.5	+135	+ 58	+136	+ 60	+139	+ 61	+141	+ 62	+143	+ 63	22.5	55	0.95	0.14									
11.0	+141	+ 40	+143	+ 41	+146	+ 42	+148	+ 43	+150	+ 43	23.0	56	0.99	.14									
11.5	+145	+ 22	+147	+ 22	+150	+ 23	+152	+ 23	+155	+ 23	23.5	57	1.03	.15									
12.0	+147	+ 2	+149	+ 3	+151	+ 3	+154	+ 3	+156	+ 3	24.0	58	1.07	.16									
												59	1.11	.17									
TO 1967.0												TO 1968.0											
h	e	f	e	f	e	f	e	f	e	f	e	f	h										
0	+2	-3	0	-3	-3	-3	+6	-3	+4	-4	+1	-3	12	60	1.15	0.18							
1	+1	-3	-1	-3	-3	-2	+5	-5	+3	-5	0	-4	13	61	1.20	.19							
2	0	-3	-2	-3	-4	-1	+4	-6	+1	-5	-1	-3	14	62	1.25	.20							
3	-1	-3	-3	-2	-4	0	+2	-6	0	-5	-2	-3	15	63	1.31	.22							
4	-1	-3	-3	-1	-4	+1	0	-7	-1	-5	-2	-3	16	64	1.37	.23							
5	-2	-3	-3	-1	-4	+2	-1	-7	-3	-5	-3	-2	17	65	1.43	0.25							
													18	66	1.50	.27							
6	-3	-2	-3	0	-3	+3	-3	-6	-4	-4	-3	-1	19	67	1.57	.29							
													20	68	1.65	.32							
7	-3	-1	-3	+1	-2	+3	-5	-5	-5	-3	-4	0	21	69	1.74	.35							
8	-3	0	-3	+2	-1	+4	-6	-4	-5	-1	-3	+1	22	70	1.83	0.38							
9	-3	+1	-2	+3	0	+4	-6	-2	-5	0	-3	+2	23	71	1.94	.42							
10	-3	+1	-1	+3	+1	+4	-7	0	-5	+1	-3	+2	24	72	2.05	.47							
11	-3	+2	-1	+3	+2	+4	-7	+1	-5	+3	-2	+3	25	73	2.18	.52							
12	-2	+3	0	+3	+3	+3	-6	+3	-4	+4	-1	+3	26	74	2.32	.58							
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FACTORS FOR COMPUTING GEOCENTRIC COORDINATES

ϕ	S	C	ϕ	S	C
± 0	0.993277	1.000000	± 45	0.994951	1.001685
1	.993278 ¹	1.000001 ¹	46	.995009 ⁵⁸	1.001744 ⁵⁹
2	.993281 ³	1.000004 ³	47	.995068 ⁵⁹	1.001803 ⁵⁹
3	.993286 ⁵	1.000009 ⁵	48	.995126 ⁵⁸	1.001862 ⁵⁹
4	.993294 ⁸	1.000016 ⁷	49	.995185 ⁵⁹	1.001920 ⁵⁸
5	0.993303	1.000026	50	0.995242	1.001978
6	.993314 ¹¹	1.000037 ¹¹	51	.995300 ⁵⁸	1.002036 ⁵⁸
7	.993327 ¹³	1.000050 ¹³	52	.995357 ⁵⁷	1.002094 ⁵⁸
8	.993342 ¹⁵	1.000065 ¹⁵	53	.995414 ⁵⁷	1.002151 ⁵⁷
9	.993359 ¹⁷	1.000082 ¹⁷	54	.995470 ⁵⁶	1.002207 ⁵⁶
10	0.993378	1.000101	55	0.995525	1.002263
11	.993399 ²¹	1.000122 ²¹	56	.995580 ⁵⁵	1.002318 ⁵⁵
12	.993422 ²³	1.000145 ²³	57	.995634 ⁵⁴	1.002373 ⁵⁵
13	.993446 ²⁴	1.000170 ²⁵	58	.995687 ⁵³	1.002426 ⁵³
14	.993473 ²⁷	1.000197 ²⁷	59	.995740 ⁵³	1.002479 ⁵³
15	0.993501	1.000225	60	0.995791	1.002531
16	.993531 ³⁰	1.000255 ³⁰	61	.995841 ⁵⁰	1.002581 ⁵⁰
17	.993563 ³²	1.000287 ³²	62	.995890 ⁴⁹	1.002631 ⁵⁰
18	.993596 ³³	1.000321 ³⁴	63	.995939 ⁴⁹	1.002679 ⁴⁸
19	.993631 ³⁵	1.000356 ³⁵	64	.995985 ⁴⁶	1.002726 ⁴⁷
20	0.993668	1.000393	65	0.996031	1.002772
21	.993706 ³⁸	1.000432 ³⁹	66	.996076 ⁴⁵	1.002817 ⁴⁵
22	.993746 ⁴⁰	1.000472 ⁴⁰	67	.996118 ⁴²	1.002860 ⁴³
23	.993787 ⁴¹	1.000514 ⁴²	68	.996160 ⁴²	1.002902 ⁴²
24	.993830 ⁴³	1.000557 ⁴³	69	.996200 ⁴⁰	1.002943 ⁴¹
25	0.993874	1.000601	70	0.996239	1.002981
26	.993920 ⁴⁶	1.000647 ⁴⁶	71	.996276 ³⁷	1.003019 ³⁸
27	.993966 ⁴⁶	1.000694 ⁴⁷	72	.996311 ³⁵	1.003054 ³⁵
28	.994014 ⁴⁸	1.000742 ⁴⁸	73	.996345 ³⁴	1.003088 ³⁴
29	.994063 ⁴⁹	1.000791 ⁴⁹	74	.996377 ³²	1.003120 ³²
30	0.994113	1.000841	75	0.996407	1.003151
31	.994164 ⁵¹	1.000893 ⁵²	76	.996436 ²⁹	1.003180 ²⁹
32	.994216 ⁵²	1.000945 ⁵²	77	.996462 ²⁶	1.003207 ²⁷
33	.994269 ⁵³	1.000999 ⁵⁴	78	.996487 ²⁵	1.003232 ²⁵
34	.994323 ⁵⁴	1.001053 ⁵⁴	79	.996510 ²³	1.003255 ²³
35	0.994378	1.001108	80	0.996531	1.003276
36	.994433 ⁵⁵	1.001163 ⁵⁵	81	.996550 ¹⁹	1.003295 ¹⁹
37	.994489 ⁵⁶	1.001220 ⁵⁷	82	.996568 ¹⁸	1.003313 ¹⁸
38	.994545 ⁵⁶	1.001277 ⁵⁷	83	.996583 ¹⁵	1.003328 ¹⁵
39	.994602 ⁵⁷	1.001334 ⁵⁷	84	.996596 ¹³	1.003341 ¹³
40	0.994660	1.001392	85	0.996607	1.003353
41	.994717 ⁵⁷	1.001450 ⁵⁸	86	.996617 ¹⁰	1.003362 ⁹
42	.994776 ⁵⁹	1.001508 ⁵⁸	87	.996624 ⁷	1.003369 ⁷
43	.994834 ⁵⁸	1.001567 ⁵⁹	88	.996629 ⁵	1.003374 ⁵
44	.994892 ⁵⁸	1.001626 ⁵⁹	89	.996632 ³	1.003377 ³
± 45	0.994951	1.001685	± 90	0.996633	1.003378

Geocentric Coordinates referred to the International Ellipsoid:

$$\rho \sin \phi' = (S + H) \sin \phi,$$

$$\rho \cos \phi' = (C + H) \cos \phi;$$

H, the altitude above sea-level in units of the equatorial radius of the Earth, is

$$0.1567794 \times 10^{-6} \times \text{altitude in m, or } 0.0477865 \times 10^{-6} \times \text{altitude in ft.}$$

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	0 ^h		1 ^h		2 ^h		3 ^h		4 ^h		5 ^h		6 ^h		7 ^h		SECONDS	
m	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	0	00.000	0	09.830	0	19.659	0	29.489	0	39.318	0	49.148	0	58.977	1	08.807	0	0.000
1	0	00.164	0	09.993	0	19.823	0	29.653	0	39.482	0	49.312	0	59.141	1	08.971	1	.003
2	0	00.328	0	10.157	0	19.987	0	29.816	0	39.646	0	49.475	0	59.305	1	09.135	2	.005
3	0	00.491	0	10.321	0	20.151	0	29.980	0	39.810	0	49.639	0	59.469	1	09.298	3	.008
4	0	00.655	0	10.485	0	20.314	0	30.144	0	39.974	0	49.803	0	59.633	1	09.462	4	.011
5	0	00.819	0	10.649	0	20.478	0	30.308	0	40.137	0	49.967	0	59.796	1	09.626	5	0.014
6	0	00.983	0	10.813	0	20.642	0	30.472	0	40.301	0	50.131	0	59.960	1	09.790	6	.016
7	0	01.147	0	10.976	0	20.806	0	30.635	0	40.465	0	50.295	1	00.124	1	09.954	7	.019
8	0	01.311	0	11.140	0	20.970	0	30.799	0	40.629	0	50.458	1	00.288	1	10.118	8	.022
9	0	01.474	0	11.304	0	21.134	0	30.963	0	40.793	0	50.622	1	00.452	1	10.281	9	.025
10	0	01.638	0	11.468	0	21.297	0	31.127	0	40.957	0	50.786	1	00.616	1	10.445	10	0.027
11	0	01.802	0	11.632	0	21.461	0	31.291	0	41.120	0	50.950	1	00.779	1	10.609	11	.030
12	0	01.966	0	11.795	0	21.625	0	31.455	0	41.284	0	51.114	1	00.943	1	10.773	12	.033
13	0	02.130	0	11.959	0	21.789	0	31.618	0	41.448	0	51.278	1	01.107	1	10.937	13	.035
14	0	02.294	0	12.123	0	21.953	0	31.782	0	41.612	0	51.441	1	01.271	1	11.100	14	.038
15	0	02.457	0	12.287	0	22.117	0	31.946	0	41.776	0	51.605	1	01.435	1	11.264	15	0.041
16	0	02.621	0	12.451	0	22.280	0	32.110	0	41.939	0	51.769	1	01.599	1	11.428	16	.044
17	0	02.785	0	12.615	0	22.444	0	32.274	0	42.103	0	51.933	1	01.762	1	11.592	17	.046
18	0	02.949	0	12.778	0	22.608	0	32.438	0	42.267	0	52.097	1	01.926	1	11.756	18	.049
19	0	03.113	0	12.942	0	22.772	0	32.601	0	42.431	0	52.260	1	02.090	1	11.920	19	.052
20	0	03.277	0	13.106	0	22.936	0	32.765	0	42.595	0	52.424	1	02.254	1	12.083	20	0.055
21	0	03.440	0	13.270	0	23.099	0	32.929	0	42.759	0	52.588	1	02.418	1	12.247	21	.057
22	0	03.604	0	13.434	0	23.263	0	33.093	0	42.922	0	52.752	1	02.582	1	12.411	22	.060
23	0	03.768	0	13.598	0	23.427	0	33.257	0	43.086	0	52.916	1	02.745	1	12.575	23	.063
24	0	03.932	0	13.761	0	23.591	0	33.421	0	43.250	0	53.080	1	02.909	1	12.739	24	.066
25	0	04.096	0	13.925	0	23.755	0	33.584	0	43.414	0	53.243	1	03.073	1	12.903	25	0.068
26	0	04.259	0	14.089	0	23.919	0	33.748	0	43.578	0	53.407	1	03.237	1	13.066	26	.071
27	0	04.423	0	14.253	0	24.082	0	33.912	0	43.742	0	53.571	1	03.401	1	13.230	27	.074
28	0	04.587	0	14.417	0	24.246	0	34.076	0	43.905	0	53.735	1	03.564	1	13.394	28	.076
29	0	04.751	0	14.581	0	24.410	0	34.240	0	44.069	0	53.899	1	03.728	1	13.558	29	.079
30	0	04.915	0	14.744	0	24.574	0	34.403	0	44.233	0	54.063	1	03.892	1	13.722	30	0.082
31	0	05.079	0	14.908	0	24.738	0	34.567	0	44.397	0	54.226	1	04.056	1	13.886	31	.085
32	0	05.242	0	15.072	0	24.902	0	34.731	0	44.561	0	54.390	1	04.220	1	14.049	32	.087
33	0	05.406	0	15.236	0	25.065	0	34.895	0	44.725	0	54.554	1	04.384	1	14.213	33	.090
34	0	05.570	0	15.400	0	25.229	0	35.059	0	44.888	0	54.718	1	04.547	1	14.377	34	.093
35	0	05.734	0	15.563	0	25.393	0	35.223	0	45.052	0	54.882	1	04.711	1	14.541	35	0.096
36	0	05.898	0	15.727	0	25.557	0	35.386	0	45.216	0	55.046	1	04.875	1	14.705	36	.098
37	0	06.062	0	15.891	0	25.721	0	35.550	0	45.380	0	55.209	1	05.039	1	14.868	37	.101
38	0	06.225	0	16.055	0	25.885	0	35.714	0	45.544	0	55.373	1	05.203	1	15.032	38	.104
39	0	06.389	0	16.219	0	26.048	0	35.878	0	45.707	0	55.537	1	05.367	1	15.196	39	.106
40	0	06.553	0	16.383	0	26.212	0	36.042	0	45.871	0	55.701	1	05.530	1	15.360	40	0.109
41	0	06.717	0	16.546	0	26.376	0	36.206	0	46.035	0	55.865	1	05.694	1	15.524	41	.112
42	0	06.881	0	16.710	0	26.540	0	36.369	0	46.199	0	56.028	1	05.858	1	15.688	42	.115
43	0	07.045	0	16.874	0	26.704	0	36.533	0	46.363	0	56.192	1	06.022	1	15.851	43	.117
44	0	07.208	0	17.038	0	26.867	0	36.697	0	46.527	0	56.356	1	06.186	1	16.015	44	.120
45	0	07.372	0	17.202	0	27.031	0	36.861	0	46.690	0	56.520	1	06.350	1	16.179	45	0.123
46	0	07.536	0	17.366	0	27.195	0	37.025	0	46.854	0	56.684	1	06.513	1	16.343	46	.126
47	0	07.700	0	17.529	0	27.359	0	37.189	0	47.018	0	56.848	1	06.677	1	16.507	47	.128
48	0	07.864	0	17.693	0	27.523	0	37.352	0	47.182	0	57.011	1	06.841	1	16.671	48	.131
49	0	08.027	0	17.857	0	27.687	0	37.516	0	47.346	0	57.175	1	07.005	1	16.834	49	.134
50	0	08.191	0	18.021	0	27.850	0	37.680	0	47.510	0	57.339	1	07.169	1	16.998	50	0.137
51	0	08.355	0	18.185	0	28.014	0	37.844	0	47.673	0	57.503	1	07.332	1	17.162	51	.139
52	0	08.519	0	18.349	0	28.178	0	38.008	0	47.837	0	57.667	1	07.496	1	17.326	52	.142
53	0	08.683	0	18.512	0	28.342	0	38.171	0	48.001	0	57.831	1	07.660	1	17.490	53	.145
54	0	08.847	0	18.676	0	28.506	0	38.335	0	48.165	0	57.994	1	07.824	1	17.654	54	.147
55	0	09.010	0	18.840	0	28.670	0	38.499	0	48.329	0	58.158	1	07.988	1	17.817	55	0.150
56	0	09.174	0	19.004	0	28.833	0	38.663	0	48.493	0	58.322	1	08.152	1	17.981	56	.153
57	0	09.338	0	19.168	0	28.997	0	38.827	0	48.656	0	58.486	1	08.315	1	18.145	57	.156
58	0	09.502	0	19.331	0	29.161	0	38.991	0	48.820	0	58.650	1	08.479	1	18.309	58	.158
59	0	09.666	0	19.495	0	29.325	0	39.154	0	48.984	0	58.814	1	08.643	1	18.473	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	8 ^h	9 ^h	10 ^h	11 ^h	12 ^h	13 ^h	14 ^h	15 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	1 18.636	1 28.466	1 38.296	1 48.125	1 57.955	2 07.784	2 17.614	2 27.443	0	0.000
1	1 18.800	1 28.630	1 38.459	1 48.289	1 58.119	2 07.948	2 17.778	2 27.607	1	.003
2	1 18.964	1 28.794	1 38.623	1 48.453	1 58.282	2 08.112	2 17.942	2 27.771	2	.005
3	1 19.128	1 28.958	1 38.787	1 48.617	1 58.446	2 08.276	2 18.105	2 27.935	3	.008
4	1 19.292	1 29.121	1 38.951	1 48.780	1 58.610	2 08.440	2 18.269	2 28.099	4	.011
5	1 19.456	1 29.285	1 39.115	1 48.944	1 58.774	2 08.603	2 18.433	2 28.263	5	0.014
6	1 19.619	1 29.449	1 39.279	1 49.108	1 58.938	2 08.767	2 18.597	2 28.426	6	.016
7	1 19.783	1 29.613	1 39.442	1 49.272	1 59.102	2 08.931	2 18.761	2 28.590	7	.019
8	1 19.947	1 29.777	1 39.606	1 49.436	1 59.265	2 09.095	2 18.924	2 28.754	8	.022
9	1 20.111	1 29.940	1 39.770	1 49.600	1 59.429	2 09.259	2 19.088	2 28.918	9	.025
10	1 20.275	1 30.104	1 39.934	1 49.763	1 59.593	2 09.423	2 19.252	2 29.082	10	0.027
11	1 20.439	1 30.268	1 40.098	1 49.927	1 59.757	2 09.586	2 19.416	2 29.246	11	.030
12	1 20.602	1 30.432	1 40.262	1 50.091	1 59.921	2 09.750	2 19.580	2 29.409	12	.033
13	1 20.766	1 30.596	1 40.425	1 50.255	2 00.084	2 09.914	2 19.744	2 29.573	13	.035
14	1 20.930	1 30.760	1 40.589	1 50.419	2 00.248	2 10.078	2 19.907	2 29.737	14	.038
15	1 21.094	1 30.923	1 40.753	1 50.583	2 00.412	2 10.242	2 20.071	2 29.901	15	0.041
16	1 21.258	1 31.087	1 40.917	1 50.746	2 00.576	2 10.406	2 20.235	2 30.065	16	.044
17	1 21.422	1 31.251	1 41.081	1 50.910	2 00.740	2 10.569	2 20.399	2 30.228	17	.046
18	1 21.585	1 31.415	1 41.244	1 51.074	2 00.904	2 10.733	2 20.563	2 30.392	18	.049
19	1 21.749	1 31.579	1 41.408	1 51.238	2 01.067	2 10.897	2 20.727	2 30.556	19	.052
20	1 21.913	1 31.743	1 41.572	1 51.402	2 01.231	2 11.061	2 20.890	2 30.720	20	0.055
21	1 22.077	1 31.906	1 41.736	1 51.566	2 01.395	2 11.225	2 21.054	2 30.884	21	.057
22	1 22.241	1 32.070	1 41.900	1 51.729	2 01.559	2 11.388	2 21.218	2 31.048	22	.060
23	1 22.404	1 32.234	1 42.064	1 51.893	2 01.723	2 11.552	2 21.382	2 31.211	23	.063
24	1 22.568	1 32.398	1 42.227	1 52.057	2 01.887	2 11.716	2 21.546	2 31.375	24	.066
25	1 22.732	1 32.562	1 42.391	1 52.221	2 02.050	2 11.880	2 21.710	2 31.539	25	0.068
26	1 22.896	1 32.726	1 42.555	1 52.385	2 02.214	2 12.044	2 21.873	2 31.703	26	.071
27	1 23.060	1 32.889	1 42.719	1 52.548	2 02.378	2 12.208	2 22.037	2 31.867	27	.074
28	1 23.224	1 33.053	1 42.883	1 52.712	2 02.542	2 12.371	2 22.201	2 32.031	28	.076
29	1 23.387	1 33.217	1 43.047	1 52.876	2 02.706	2 12.535	2 22.365	2 32.194	29	.079
30	1 23.551	1 33.381	1 43.210	1 53.040	2 02.870	2 12.699	2 22.529	2 32.358	30	0.082
31	1 23.715	1 33.545	1 43.374	1 53.204	2 03.033	2 12.863	2 22.692	2 32.522	31	.085
32	1 23.879	1 33.708	1 43.538	1 53.368	2 03.197	2 13.027	2 22.856	2 32.686	32	.087
33	1 24.043	1 33.872	1 43.702	1 53.531	2 03.361	2 13.191	2 23.020	2 32.850	33	.090
34	1 24.207	1 34.036	1 43.866	1 53.695	2 03.525	2 13.354	2 23.184	2 33.013	34	.093
35	1 24.370	1 34.200	1 44.030	1 53.859	2 03.689	2 13.518	2 23.348	2 33.177	35	0.096
36	1 24.534	1 34.364	1 44.193	1 54.023	2 03.852	2 13.682	2 23.512	2 33.341	36	.098
37	1 24.698	1 34.528	1 44.357	1 54.187	2 04.016	2 13.846	2 23.675	2 33.505	37	.101
38	1 24.862	1 34.691	1 44.521	1 54.351	2 04.180	2 14.010	2 23.839	2 33.669	38	.104
39	1 25.026	1 34.855	1 44.685	1 54.514	2 04.344	2 14.174	2 24.003	2 33.833	39	.106
40	1 25.190	1 35.019	1 44.849	1 54.678	2 04.508	2 14.337	2 24.167	2 33.996	40	0.109
41	1 25.353	1 35.183	1 45.012	1 54.842	2 04.672	2 14.501	2 24.331	2 34.160	41	.112
42	1 25.517	1 35.347	1 45.176	1 55.006	2 04.835	2 14.665	2 24.495	2 34.324	42	.115
43	1 25.681	1 35.511	1 45.340	1 55.170	2 04.999	2 14.829	2 24.658	2 34.488	43	.117
44	1 25.845	1 35.674	1 45.504	1 55.334	2 05.163	2 14.993	2 24.822	2 34.652	44	.120
45	1 26.009	1 35.838	1 45.668	1 55.497	2 05.327	2 15.156	2 24.986	2 34.816	45	0.123
46	1 26.172	1 36.002	1 45.832	1 55.661	2 05.491	2 15.320	2 25.150	2 34.979	46	.126
47	1 26.336	1 36.166	1 45.995	1 55.825	2 05.655	2 15.484	2 25.314	2 35.143	47	.128
48	1 26.500	1 36.330	1 46.159	1 55.989	2 05.818	2 15.648	2 25.478	2 35.307	48	.131
49	1 26.664	1 36.494	1 46.323	1 56.153	2 05.982	2 15.812	2 25.641	2 35.471	49	.134
50	1 26.828	1 36.657	1 46.487	1 56.316	2 06.146	2 15.976	2 25.805	2 35.635	50	0.137
51	1 26.992	1 36.821	1 46.651	1 56.480	2 06.310	2 16.139	2 25.969	2 35.799	51	.139
52	1 27.155	1 36.985	1 46.815	1 56.644	2 06.474	2 16.303	2 26.133	2 35.962	52	.142
53	1 27.319	1 37.149	1 46.978	1 56.808	2 06.638	2 16.467	2 26.297	2 36.126	53	.145
54	1 27.483	1 37.313	1 47.142	1 56.972	2 06.801	2 16.631	2 26.460	2 36.290	54	.147
55	1 27.647	1 37.476	1 47.306	1 57.136	2 06.965	2 16.795	2 26.624	2 36.454	55	0.150
56	1 27.811	1 37.640	1 47.470	1 57.299	2 07.129	2 16.959	2 26.788	2 36.618	56	.153
57	1 27.975	1 37.804	1 47.634	1 57.463	2 07.293	2 17.122	2 26.952	2 36.781	57	.156
58	1 28.138	1 37.968	1 47.798	1 57.627	2 07.457	2 17.286	2 27.116	2 36.945	58	.158
59	1 28.302	1 38.132	1 47.961	1 57.791	2 07.620	2 17.450	2 27.280	2 37.109	59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SIDEREAL INTO MEAN SOLAR TIME

	16 ^h		17 ^h		18 ^h		19 ^h		20 ^h		21 ^h		22 ^h		23 ^h		SECONDS	
m	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	2 37.273		2 47.103		2 56.932		3 06.762		3 16.591		3 26.421		3 36.250		3 46.080		0	0.000
1	2 37.437		2 47.266		2 57.096		3 06.925		3 16.755		3 26.585		3 36.414		3 46.244		1	.003
2	2 37.601		2 47.430		2 57.260		3 07.089		3 16.919		3 26.748		3 36.578		3 46.408		2	.005
3	2 37.764		2 47.594		2 57.424		3 07.253		3 17.083		3 26.912		3 36.742		3 46.571		3	.008
4	2 37.928		2 47.758		2 57.587		3 07.417		3 17.247		3 27.076		3 36.906		3 46.735		4	.011
5	2 38.092		2 47.922		2 57.751		3 07.581		3 17.410		3 27.240		3 37.069		3 46.899		5	0.014
6	2 38.256		2 48.085		2 57.915		3 07.745		3 17.574		3 27.404		3 37.233		3 47.063		6	.016
7	2 38.420		2 48.249		2 58.079		3 07.908		3 17.738		3 27.568		3 37.397		3 47.227		7	.019
8	2 38.584		2 48.413		2 58.243		3 08.072		3 17.902		3 27.731		3 37.561		3 47.391		8	.022
9	2 38.747		2 48.577		2 58.407		3 08.236		3 18.066		3 27.895		3 37.725		3 47.554		9	.025
10	2 38.911		2 48.741		2 58.570		3 08.400		3 18.229		3 28.059		3 37.889		3 47.718		10	0.027
11	2 39.075		2 48.905		2 58.734		3 08.564		3 18.393		3 28.223		3 38.052		3 47.882		11	.030
12	2 39.239		2 49.068		2 58.898		3 08.728		3 18.557		3 28.387		3 38.216		3 48.046		12	.033
13	2 39.403		2 49.232		2 59.062		3 08.891		3 18.721		3 28.551		3 38.380		3 48.210		13	.035
14	2 39.567		2 49.396		2 59.226		3 09.055		3 18.885		3 28.714		3 38.544		3 48.373		14	.038
15	2 39.730		2 49.560		2 59.389		3 09.219		3 19.049		3 28.878		3 38.708		3 48.537		15	0.041
16	2 39.894		2 49.724		2 59.553		3 09.383		3 19.212		3 29.042		3 38.872		3 48.701		16	.044
17	2 40.058		2 49.888		2 59.717		3 09.547		3 19.376		3 29.206		3 39.035		3 48.865		17	.046
18	2 40.222		2 50.051		2 59.881		3 09.711		3 19.540		3 29.370		3 39.199		3 49.029		18	.049
19	2 40.386		2 50.215		3 00.045		3 09.874		3 19.704		3 29.533		3 39.363		3 49.193		19	.052
20	2 40.549		2 50.379		3 00.209		3 10.038		3 19.868		3 29.697		3 39.527		3 49.356		20	0.055
21	2 40.713		2 50.543		3 00.372		3 10.202		3 20.032		3 29.861		3 39.691		3 49.520		21	.057
22	2 40.877		2 50.707		3 00.536		3 10.366		3 20.195		3 30.025		3 39.855		3 49.684		22	.060
23	2 41.041		2 50.871		3 00.700		3 10.530		3 20.359		3 30.189		3 40.018		3 49.848		23	.063
24	2 41.205		2 51.034		3 00.864		3 10.693		3 20.523		3 30.353		3 40.182		3 50.012		24	.066
25	2 41.369		2 51.198		3 01.028		3 10.857		3 20.687		3 30.516		3 40.346		3 50.176		25	0.068
26	2 41.532		2 51.362		3 01.192		3 11.021		3 20.851		3 30.680		3 40.510		3 50.339		26	.071
27	2 41.696		2 51.526		3 01.355		3 11.185		3 21.015		3 30.844		3 40.674		3 50.503		27	.074
28	2 41.860		2 51.690		3 01.519		3 11.349		3 21.178		3 31.008		3 40.837		3 50.667		28	.076
29	2 42.024		2 51.853		3 01.683		3 11.513		3 21.342		3 31.172		3 41.001		3 50.831		29	.079
30	2 42.188		2 52.017		3 01.847		3 11.676		3 21.506		3 31.336		3 41.165		3 50.995		30	0.082
31	2 42.352		2 52.181		3 02.011		3 11.840		3 21.670		3 31.499		3 41.329		3 51.159		31	.085
32	2 42.515		2 52.345		3 02.175		3 12.004		3 21.834		3 31.663		3 41.493		3 51.322		32	.087
33	2 42.679		2 52.509		3 02.338		3 12.168		3 21.997		3 31.827		3 41.657		3 51.486		33	.090
34	2 42.843		2 52.673		3 02.502		3 12.332		3 22.161		3 31.991		3 41.820		3 51.650		34	.093
35	2 43.007		2 52.836		3 02.666		3 12.496		3 22.325		3 32.155		3 41.984		3 51.814		35	0.096
36	2 43.171		2 53.000		3 02.830		3 12.659		3 22.489		3 32.319		3 42.148		3 51.978		36	.098
37	2 43.335		2 53.164		3 02.994		3 12.823		3 22.653		3 32.482		3 42.312		3 52.141		37	.101
38	2 43.498		2 53.328		3 03.157		3 12.987		3 22.817		3 32.646		3 42.476		3 52.305		38	.104
39	2 43.662		2 53.492		3 03.321		3 13.151		3 22.980		3 32.810		3 42.640		3 52.469		39	.106
40	2 43.826		2 53.656		3 03.485		3 13.315		3 23.144		3 32.974		3 42.803		3 52.633		40	0.109
41	2 43.990		2 53.819		3 03.649		3 13.479		3 23.308		3 33.138		3 42.967		3 52.797		41	.112
42	2 44.154		2 53.983		3 03.813		3 13.642		3 23.472		3 33.301		3 43.131		3 52.961		42	.115
43	2 44.317		2 54.147		3 03.977		3 13.806		3 23.636		3 33.465		3 43.295		3 53.124		43	.117
44	2 44.481		2 54.311		3 04.140		3 13.970		3 23.800		3 33.629		3 43.459		3 53.288		44	.120
45	2 44.645		2 54.475		3 04.304		3 14.134		3 23.963		3 33.793		3 43.623		3 53.452		45	0.123
46	2 44.809		2 54.639		3 04.468		3 14.298		3 24.127		3 33.957		3 43.786		3 53.616		46	.126
47	2 44.973		2 54.802		3 04.632		3 14.461		3 24.291		3 34.121		3 43.950		3 53.780		47	.128
48	2 45.137		2 54.966		3 04.796		3 14.625		3 24.455		3 34.284		3 44.114		3 53.944		48	.131
49	2 45.300		2 55.130		3 04.960		3 14.789		3 24.619		3 34.448		3 44.278		3 54.107		49	.134
50	2 45.464		2 55.294		3 05.123		3 14.953		3 24.783		3 34.612		3 44.442		3 54.271		50	0.137
51	2 45.628		2 55.458		3 05.287		3 15.117		3 24.946		3 34.776		3 44.605		3 54.435		51	.139
52	2 45.792		2 55.621		3 05.451		3 15.281		3 25.110		3 34.940		3 44.769		3 54.599		52	.142
53	2 45.956		2 55.785		3 05.615		3 15.444		3 25.274		3 35.104		3 44.933		3 54.763		53	.145
54	2 46.120		2 55.949		3 05.779		3 15.608		3 25.438		3 35.267		3 45.097		3 54.927		54	.147
55	2 46.283		2 56.113		3 05.943		3 15.772		3 25.602		3 35.431		3 45.261		3 55.090		55	0.150
56	2 46.447		2 56.277		3 06.106		3 15.936		3 25.765		3 35.595		3 45.425		3 55.254		56	.153
57	2 46.611		2 56.441		3 06.270		3 16.100		3 25.929		3 35.759		3 45.588		3 55.418		57	.156
58	2 46.775		2 56.604		3 06.434		3 16.264		3 26.093		3 35.923		3 45.752		3 55.582		58	.158
59	2 46.939		2 56.768		3 06.598		3 16.427		3 26.257		3 36.087		3 45.916		3 55.746		59	0.161

Subtract tabular amount from mean sidereal time interval to obtain equivalent mean solar time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	6 ^h	7 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	0 00.000	0 09.856	0 19.713	0 29.569	0 39.426	0 49.282	0 59.139	1 08.995	0	0.000
1	0 00.164	0 10.021	0 19.877	0 29.734	0 39.590	0 49.447	0 59.303	1 09.160	1	.003
2	0 00.329	0 10.185	0 20.041	0 29.898	0 39.754	0 49.611	0 59.467	1 09.324	2	.005
3	0 00.493	0 10.349	0 20.206	0 30.062	0 39.919	0 49.775	0 59.632	1 09.488	3	.008
4	0 00.657	0 10.514	0 20.370	0 30.227	0 40.083	0 49.939	0 59.796	1 09.652	4	.011
5	0 00.821	0 10.678	0 20.534	0 30.391	0 40.247	0 50.104	0 59.960	1 09.817	5	0.014
6	0 00.986	0 10.842	0 20.699	0 30.555	0 40.412	0 50.268	1 00.124	1 09.981	6	.016
7	0 01.150	0 11.006	0 20.863	0 30.719	0 40.576	0 50.432	1 00.289	1 10.145	7	.019
8	0 01.314	0 11.171	0 21.027	0 30.884	0 40.740	0 50.597	1 00.453	1 10.310	8	.022
9	0 01.478	0 11.335	0 21.191	0 31.048	0 40.904	0 50.761	1 00.617	1 10.474	9	.025
10	0 01.643	0 11.499	0 21.356	0 31.212	0 41.069	0 50.925	1 00.782	1 10.638	10	0.027
11	0 01.807	0 11.663	0 21.520	0 31.376	0 41.233	0 51.089	1 00.946	1 10.802	11	.030
12	0 01.971	0 11.828	0 21.684	0 31.541	0 41.397	0 51.254	1 01.110	1 10.967	12	.033
13	0 02.136	0 11.992	0 21.849	0 31.705	0 41.561	0 51.418	1 01.274	1 11.131	13	.036
14	0 02.300	0 12.156	0 22.013	0 31.869	0 41.726	0 51.582	1 01.439	1 11.295	14	.038
15	0 02.464	0 12.321	0 22.177	0 32.034	0 41.890	0 51.746	1 01.603	1 11.459	15	0.041
16	0 02.628	0 12.485	0 22.341	0 32.198	0 42.054	0 51.911	1 01.767	1 11.624	16	.044
17	0 02.793	0 12.649	0 22.506	0 32.362	0 42.219	0 52.075	1 01.932	1 11.788	17	.047
18	0 02.957	0 12.813	0 22.670	0 32.526	0 42.383	0 52.239	1 02.096	1 11.952	18	.049
19	0 03.121	0 12.978	0 22.834	0 32.691	0 42.547	0 52.404	1 02.260	1 12.117	19	.052
20	0 03.285	0 13.142	0 22.998	0 32.855	0 42.711	0 52.568	1 02.424	1 12.281	20	0.055
21	0 03.450	0 13.306	0 23.163	0 33.019	0 42.876	0 52.732	1 02.589	1 12.445	21	.057
22	0 03.614	0 13.471	0 23.327	0 33.183	0 43.040	0 52.896	1 02.753	1 12.609	22	.060
23	0 03.778	0 13.635	0 23.491	0 33.348	0 43.204	0 53.061	1 02.917	1 12.774	23	.063
24	0 03.943	0 13.799	0 23.656	0 33.512	0 43.368	0 53.225	1 03.081	1 12.938	24	.066
25	0 04.107	0 13.963	0 23.820	0 33.676	0 43.533	0 53.389	1 03.246	1 13.102	25	0.068
26	0 04.271	0 14.128	0 23.984	0 33.841	0 43.697	0 53.554	1 03.410	1 13.266	26	.071
27	0 04.435	0 14.292	0 24.148	0 34.005	0 43.861	0 53.718	1 03.574	1 13.431	27	.074
28	0 04.600	0 14.456	0 24.313	0 34.169	0 44.026	0 53.882	1 03.739	1 13.595	28	.077
29	0 04.764	0 14.620	0 24.477	0 34.333	0 44.190	0 54.046	1 03.903	1 13.759	29	.079
30	0 04.928	0 14.785	0 24.641	0 34.498	0 44.354	0 54.211	1 04.067	1 13.924	30	0.082
31	0 05.093	0 14.949	0 24.805	0 34.662	0 44.518	0 54.375	1 04.231	1 14.088	31	.085
32	0 05.257	0 15.113	0 24.970	0 34.826	0 44.683	0 54.539	1 04.396	1 14.252	32	.088
33	0 05.421	0 15.278	0 25.134	0 34.990	0 44.847	0 54.703	1 04.560	1 14.416	33	.090
34	0 05.585	0 15.442	0 25.298	0 35.155	0 45.011	0 54.868	1 04.724	1 14.581	34	.093
35	0 05.750	0 15.606	0 25.463	0 35.319	0 45.176	0 55.032	1 04.888	1 14.745	35	0.096
36	0 05.914	0 15.770	0 25.627	0 35.483	0 45.340	0 55.196	1 05.053	1 14.909	36	.099
37	0 06.078	0 15.935	0 25.791	0 35.648	0 45.504	0 55.361	1 05.217	1 15.073	37	.101
38	0 06.242	0 16.099	0 25.955	0 35.812	0 45.668	0 55.525	1 05.381	1 15.238	38	.104
39	0 06.407	0 16.263	0 26.120	0 35.976	0 45.833	0 55.689	1 05.546	1 15.402	39	.107
40	0 06.571	0 16.427	0 26.284	0 36.140	0 45.997	0 55.853	1 05.710	1 15.566	40	0.110
41	0 06.735	0 16.592	0 26.448	0 36.305	0 46.161	0 56.018	1 05.874	1 15.731	41	.112
42	0 06.900	0 16.756	0 26.612	0 36.469	0 46.325	0 56.182	1 06.038	1 15.895	42	.115
43	0 07.064	0 16.920	0 26.777	0 36.633	0 46.490	0 56.346	1 06.203	1 16.059	43	.118
44	0 07.228	0 17.085	0 26.941	0 36.798	0 46.654	0 56.510	1 06.367	1 16.223	44	.120
45	0 07.392	0 17.249	0 27.105	0 36.962	0 46.818	0 56.675	1 06.531	1 16.388	45	0.123
46	0 07.557	0 17.413	0 27.270	0 37.126	0 46.983	0 56.839	1 06.695	1 16.552	46	.126
47	0 07.721	0 17.577	0 27.434	0 37.290	0 47.147	0 57.003	1 06.860	1 16.716	47	.129
48	0 07.885	0 17.742	0 27.598	0 37.455	0 47.311	0 57.168	1 07.024	1 16.880	48	.131
49	0 08.049	0 17.906	0 27.762	0 37.619	0 47.475	0 57.332	1 07.188	1 17.045	49	.134
50	0 08.214	0 18.070	0 27.927	0 37.783	0 47.640	0 57.496	1 07.353	1 17.209	50	0.137
51	0 08.378	0 18.234	0 28.091	0 37.947	0 47.804	0 57.660	1 07.517	1 17.373	51	.140
52	0 08.542	0 18.399	0 28.255	0 38.112	0 47.968	0 57.825	1 07.681	1 17.538	52	.142
53	0 08.707	0 18.563	0 28.419	0 38.276	0 48.132	0 57.989	1 07.845	1 17.702	53	.145
54	0 08.871	0 18.727	0 28.584	0 38.440	0 48.297	0 58.153	1 08.010	1 17.866	54	.148
55	0 09.035	0 18.892	0 28.748	0 38.605	0 48.461	0 58.317	1 08.174	1 18.030	55	0.151
56	0 09.199	0 19.056	0 28.912	0 38.769	0 48.625	0 58.482	1 08.338	1 18.195	56	.153
57	0 09.364	0 19.220	0 29.077	0 38.933	0 48.790	0 58.646	1 08.502	1 18.359	57	.156
58	0 09.528	0 19.384	0 29.241	0 39.097	0 48.954	0 58.810	1 08.667	1 18.523	58	.159
59	0 09.692	0 19.549	0 29.405	0 39.262	0 49.118	0 58.975	1 08.831	1 18.688	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	8 ^h		9 ^h		10 ^h		11 ^h		12 ^h		13 ^h		14 ^h		15 ^h		SECONDS	
m	m	s	m	s	m	s	m	s	m	s	m	s	m	s	m	s	s	s
0	1	18.852	1	28.708	1	38.565	1	48.421	1	58.278	2	08.134	2	17.991	2	27.847	0	0.000
1	1	19.016	1	28.873	1	38.729	1	48.585	1	58.442	2	08.298	2	18.155	2	28.011	1	.003
2	1	19.180	1	29.037	1	38.893	1	48.750	1	58.606	2	08.463	2	18.319	2	28.176	2	.005
3	1	19.345	1	29.201	1	39.058	1	48.914	1	58.771	2	08.627	2	18.483	2	28.340	3	.008
4	1	19.509	1	29.365	1	39.222	1	49.078	1	58.935	2	08.791	2	18.648	2	28.504	4	.011
5	1	19.673	1	29.530	1	39.386	1	49.243	1	59.099	2	08.956	2	18.812	2	28.668	5	0.014
6	1	19.837	1	29.694	1	39.550	1	49.407	1	59.263	2	09.120	2	18.976	2	28.833	6	.016
7	1	20.002	1	29.858	1	39.715	1	49.571	1	59.428	2	09.284	2	19.141	2	28.997	7	.019
8	1	20.166	1	30.022	1	39.879	1	49.735	1	59.592	2	09.448	2	19.305	2	29.161	8	.022
9	1	20.330	1	30.187	1	40.043	1	49.900	1	59.756	2	09.613	2	19.469	2	29.326	9	.025
10	1	20.495	1	30.351	1	40.207	1	50.064	1	59.920	2	09.777	2	19.633	2	29.490	10	0.027
11	1	20.659	1	30.515	1	40.372	1	50.228	2	00.085	2	09.941	2	19.798	2	29.654	11	.030
12	1	20.823	1	30.680	1	40.536	1	50.393	2	00.249	2	10.105	2	19.962	2	29.818	12	.033
13	1	20.987	1	30.844	1	40.700	1	50.557	2	00.413	2	10.270	2	20.126	2	29.983	13	.036
14	1	21.152	1	31.008	1	40.865	1	50.721	2	00.578	2	10.434	2	20.290	2	30.147	14	.038
15	1	21.316	1	31.172	1	41.029	1	50.885	2	00.742	2	10.598	2	20.455	2	30.311	15	0.041
16	1	21.480	1	31.337	1	41.193	1	51.050	2	00.906	2	10.763	2	20.619	2	30.475	16	.044
17	1	21.644	1	31.501	1	41.357	1	51.214	2	01.070	2	10.927	2	20.783	2	30.640	17	.047
18	1	21.809	1	31.665	1	41.522	1	51.378	2	01.235	2	11.091	2	20.948	2	30.804	18	.049
19	1	21.973	1	31.829	1	41.686	1	51.542	2	01.399	2	11.255	2	21.112	2	30.968	19	.052
20	1	22.137	1	31.994	1	41.850	1	51.707	2	01.563	2	11.420	2	21.276	2	31.133	20	0.055
21	1	22.302	1	32.158	1	42.015	1	51.871	2	01.727	2	11.584	2	21.440	2	31.297	21	.057
22	1	22.466	1	32.322	1	42.179	1	52.035	2	01.892	2	11.748	2	21.605	2	31.461	22	.060
23	1	22.630	1	32.487	1	42.343	1	52.200	2	02.056	2	11.912	2	21.769	2	31.625	23	.063
24	1	22.794	1	32.651	1	42.507	1	52.364	2	02.220	2	12.077	2	21.933	2	31.790	24	.066
25	1	22.959	1	32.815	1	42.672	1	52.528	2	02.385	2	12.241	2	22.097	2	31.954	25	0.068
26	1	23.123	1	32.979	1	42.836	1	52.692	2	02.549	2	12.405	2	22.262	2	32.118	26	.071
27	1	23.287	1	33.144	1	43.000	1	52.857	2	02.713	2	12.570	2	22.426	2	32.283	27	.074
28	1	23.451	1	33.308	1	43.164	1	53.021	2	02.877	2	12.734	2	22.590	2	32.447	28	.077
29	1	23.616	1	33.472	1	43.329	1	53.185	2	03.042	2	12.898	2	22.755	2	32.611	29	.079
30	1	23.780	1	33.636	1	43.493	1	53.349	2	03.206	2	13.062	2	22.919	2	32.775	30	0.082
31	1	23.944	1	33.801	1	43.657	1	53.514	2	03.370	2	13.227	2	23.083	2	32.940	31	.085
32	1	24.109	1	33.965	1	43.822	1	53.678	2	03.534	2	13.391	2	23.247	2	33.104	32	.088
33	1	24.273	1	34.129	1	43.986	1	53.842	2	03.699	2	13.555	2	23.412	2	33.268	33	.090
34	1	24.437	1	34.294	1	44.150	1	54.007	2	03.863	2	13.719	2	23.576	2	33.432	34	.093
35	1	24.601	1	34.458	1	44.314	1	54.171	2	04.027	2	13.884	2	23.740	2	33.597	35	0.096
36	1	24.766	1	34.622	1	44.479	1	54.335	2	04.192	2	14.048	2	23.905	2	33.761	36	.099
37	1	24.930	1	34.786	1	44.643	1	54.499	2	04.356	2	14.212	2	24.069	2	33.925	37	.101
38	1	25.094	1	34.951	1	44.807	1	54.664	2	04.520	2	14.377	2	24.233	2	34.090	38	.104
39	1	25.258	1	35.115	1	44.971	1	54.828	2	04.684	2	14.541	2	24.397	2	34.254	39	.107
40	1	25.423	1	35.279	1	45.136	1	54.992	2	04.849	2	14.705	2	24.562	2	34.418	40	0.110
41	1	25.587	1	35.444	1	45.300	1	55.156	2	05.013	2	14.869	2	24.726	2	34.582	41	.112
42	1	25.751	1	35.608	1	45.464	1	55.321	2	05.177	2	15.034	2	24.890	2	34.747	42	.115
43	1	25.916	1	35.772	1	45.629	1	55.485	2	05.341	2	15.198	2	25.054	2	34.911	43	.118
44	1	26.080	1	35.936	1	45.793	1	55.649	2	05.506	2	15.362	2	25.219	2	35.075	44	.120
45	1	26.244	1	36.101	1	45.957	1	55.814	2	05.670	2	15.527	2	25.383	2	35.239	45	0.123
46	1	26.408	1	36.265	1	46.121	1	55.978	2	05.834	2	15.691	2	25.547	2	35.404	46	.126
47	1	26.573	1	36.429	1	46.286	1	56.142	2	05.999	2	15.855	2	25.712	2	35.568	47	.129
48	1	26.737	1	36.593	1	46.450	1	56.306	2	06.163	2	16.019	2	25.876	2	35.732	48	.131
49	1	26.901	1	36.758	1	46.614	1	56.471	2	06.327	2	16.184	2	26.040	2	35.897	49	.134
50	1	27.066	1	36.922	1	46.778	1	56.635	2	06.491	2	16.348	2	26.204	2	36.061	50	0.137
51	1	27.230	1	37.086	1	46.943	1	56.799	2	06.656	2	16.512	2	26.369	2	36.225	51	.140
52	1	27.394	1	37.251	1	47.107	1	56.963	2	06.820	2	16.676	2	26.533	2	36.389	52	.142
53	1	27.558	1	37.415	1	47.271	1	57.128	2	06.984	2	16.841	2	26.697	2	36.554	53	.145
54	1	27.723	1	37.579	1	47.436	1	57.292	2	07.149	2	17.005	2	26.861	2	36.718	54	.148
55	1	27.887	1	37.743	1	47.600	1	57.456	2	07.313	2	17.169	2	27.026	2	36.882	55	0.151
56	1	28.051	1	37.908	1	47.764	1	57.621	2	07.477	2	17.334	2	27.190	2	37.046	56	.153
57	1	28.215	1	38.072	1	47.928	1	57.785	2	07.641	2	17.498	2	27.354	2	37.211	57	.156
58	1	28.380	1	38.236	1	48.093	1	57.949	2	07.806	2	17.662	2	27.519	2	37.375	58	.159
59	1	28.544	1	38.400	1	48.257	1	58.113	2	07.970	2	17.826	2	27.683	2	37.539	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF MEAN SOLAR INTO MEAN SIDEREAL TIME

	16 ^h	17 ^h	18 ^h	19 ^h	20 ^h	21 ^h	22 ^h	23 ^h	SECONDS	
m	m s	m s	m s	m s	m s	m s	m s	m s	s	s
0	2 37.704	2 47.560	2 57.417	3 07.273	3 17.129	3 26.986	3 36.842	3 46.699	0	0.000
1	2 37.868	2 47.724	2 57.581	3 07.437	3 17.294	3 27.150	3 37.007	3 46.863	1	.003
2	2 38.032	2 47.889	2 57.745	3 07.602	3 17.458	3 27.314	3 37.171	3 47.027	2	.005
3	2 38.196	2 48.053	2 57.909	3 07.766	3 17.622	3 27.479	3 37.335	3 47.192	3	.008
4	2 38.361	2 48.217	2 58.074	3 07.930	3 17.787	3 27.643	3 37.500	3 47.356	4	.011
5	2 38.525	2 48.381	2 58.238	3 08.094	3 17.951	3 27.807	3 37.664	3 47.520	5	0.014
6	2 38.689	2 48.546	2 58.402	3 08.259	3 18.115	3 27.972	3 37.828	3 47.685	6	.016
7	2 38.853	2 48.710	2 58.566	3 08.423	3 18.279	3 28.136	3 37.992	3 47.849	7	.019
8	2 39.018	2 48.874	2 58.731	3 08.587	3 18.444	3 28.300	3 38.157	3 48.013	8	.022
9	2 39.182	2 49.039	2 58.895	3 08.751	3 18.608	3 28.464	3 38.321	3 48.177	9	.025
10	2 39.346	2 49.203	2 59.059	3 08.916	3 18.772	3 28.629	3 38.485	3 48.342	10	0.027
11	2 39.511	2 49.367	2 59.224	3 09.080	3 18.936	3 28.793	3 38.649	3 48.506	11	.030
12	2 39.675	2 49.531	2 59.388	3 09.244	3 19.101	3 28.957	3 38.814	3 48.670	12	.033
13	2 39.839	2 49.696	2 59.552	3 09.409	3 19.265	3 29.122	3 38.978	3 48.834	13	.036
14	2 40.003	2 49.860	2 59.716	3 09.573	3 19.429	3 29.286	3 39.142	3 48.999	14	.038
15	2 40.168	2 50.024	2 59.881	3 09.737	3 19.594	3 29.450	3 39.307	3 49.163	15	0.041
16	2 40.332	2 50.188	3 00.045	3 09.901	3 19.758	3 29.614	3 39.471	3 49.327	16	.044
17	2 40.496	2 50.353	3 00.209	3 10.066	3 19.922	3 29.779	3 39.635	3 49.492	17	.047
18	2 40.661	2 50.517	3 00.373	3 10.230	3 20.086	3 29.943	3 39.799	3 49.656	18	.049
19	2 40.825	2 50.681	3 00.538	3 10.394	3 20.251	3 30.107	3 39.964	3 49.820	19	.052
20	2 40.989	2 50.846	3 00.702	3 10.558	3 20.415	3 30.271	3 40.128	3 49.984	20	0.055
21	2 41.153	2 51.010	3 00.866	3 10.723	3 20.579	3 30.436	3 40.292	3 50.149	21	.057
22	2 41.318	2 51.174	3 01.031	3 10.887	3 20.744	3 30.600	3 40.456	3 50.313	22	.060
23	2 41.482	2 51.338	3 01.195	3 11.051	3 20.908	3 30.764	3 40.621	3 50.477	23	.063
24	2 41.646	2 51.503	3 01.359	3 11.216	3 21.072	3 30.929	3 40.785	3 50.641	24	.066
25	2 41.810	2 51.667	3 01.523	3 11.380	3 21.236	3 31.093	3 40.949	3 50.806	25	0.068
26	2 41.975	2 51.831	3 01.688	3 11.544	3 21.401	3 31.257	3 41.114	3 50.970	26	.071
27	2 42.139	2 51.995	3 01.852	3 11.708	3 21.565	3 31.421	3 41.278	3 51.134	27	.074
28	2 42.303	2 52.160	3 02.016	3 11.873	3 21.729	3 31.586	3 41.442	3 51.299	28	.077
29	2 42.468	2 52.324	3 02.180	3 12.037	3 21.893	3 31.750	3 41.606	3 51.463	29	.079
30	2 42.632	2 52.488	3 02.345	3 12.201	3 22.058	3 31.914	3 41.771	3 51.627	30	0.082
31	2 42.796	2 52.653	3 02.509	3 12.366	3 22.222	3 32.078	3 41.935	3 51.791	31	.085
32	2 42.960	2 52.817	3 02.673	3 12.530	3 22.386	3 32.243	3 42.099	3 51.956	32	.088
33	2 43.125	2 52.981	3 02.838	3 12.694	3 22.551	3 32.407	3 42.263	3 52.120	33	.090
34	2 43.289	2 53.145	3 03.002	3 12.858	3 22.715	3 32.571	3 42.428	3 52.284	34	.093
35	2 43.453	2 53.310	3 03.166	3 13.023	3 22.879	3 32.736	3 42.592	3 52.448	35	0.096
36	2 43.617	2 53.474	3 03.330	3 13.187	3 23.043	3 32.900	3 42.756	3 52.613	36	.099
37	2 43.782	2 53.638	3 03.495	3 13.351	3 23.208	3 33.064	3 42.921	3 52.777	37	.101
38	2 43.946	2 53.802	3 03.659	3 13.515	3 23.372	3 33.228	3 43.085	3 52.941	38	.104
39	2 44.110	2 53.967	3 03.823	3 13.680	3 23.536	3 33.393	3 43.249	3 53.106	39	.107
40	2 44.275	2 54.131	3 03.988	3 13.844	3 23.700	3 33.557	3 43.413	3 53.270	40	0.110
41	2 44.439	2 54.295	3 04.152	3 14.008	3 23.865	3 33.721	3 43.578	3 53.434	41	.112
42	2 44.603	2 54.460	3 04.316	3 14.173	3 24.029	3 33.885	3 43.742	3 53.598	42	.115
43	2 44.767	2 54.624	3 04.480	3 14.337	3 24.193	3 34.050	3 43.906	3 53.763	43	.118
44	2 44.932	2 54.788	3 04.645	3 14.501	3 24.358	3 34.214	3 44.070	3 53.927	44	.120
45	2 45.096	2 54.952	3 04.809	3 14.665	3 24.522	3 34.378	3 44.235	3 54.091	45	0.123
46	2 45.260	2 55.117	3 04.973	3 14.830	3 24.686	3 34.543	3 44.399	3 54.256	46	.126
47	2 45.424	2 55.281	3 05.137	3 14.994	3 24.850	3 34.707	3 44.563	3 54.420	47	.129
48	2 45.589	2 55.445	3 05.302	3 15.158	3 25.015	3 34.871	3 44.728	3 54.584	48	.131
49	2 45.753	2 55.610	3 05.466	3 15.322	3 25.179	3 35.035	3 44.892	3 54.748	49	.134
50	2 45.917	2 55.774	3 05.630	3 15.487	3 25.343	3 35.200	3 45.056	3 54.913	50	0.137
51	2 46.082	2 55.938	3 05.795	3 15.651	3 25.507	3 35.364	3 45.220	3 55.077	51	.140
52	2 46.246	2 56.102	3 05.959	3 15.815	3 25.672	3 35.528	3 45.385	3 55.241	52	.142
53	2 46.410	2 56.267	3 06.123	3 15.980	3 25.836	3 35.692	3 45.549	3 55.405	53	.145
54	2 46.574	2 56.431	3 06.287	3 16.144	3 26.000	3 35.857	3 45.713	3 55.570	54	.148
55	2 46.739	2 56.595	3 06.452	3 16.308	3 26.165	3 36.021	3 45.878	3 55.734	55	0.151
56	2 46.903	2 56.759	3 06.616	3 16.472	3 26.329	3 36.185	3 46.042	3 55.898	56	.153
57	2 47.067	2 56.924	3 06.780	3 16.637	3 26.493	3 36.350	3 46.206	3 56.063	57	.156
58	2 47.232	2 57.088	3 06.944	3 16.801	3 26.657	3 36.514	3 46.370	3 56.227	58	.159
59	2 47.396	2 57.252	3 07.109	3 16.965	3 26.822	3 36.678	3 46.535	3 56.391	59	0.162

Add tabular amount to mean solar time interval to obtain equivalent mean sidereal time interval.

CONVERSION OF HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

	0 ^h	1 ^h	2 ^h	3 ^h	4 ^h	5 ^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.000 000	0.041 667	0.083 333	0.125 000	0.166 667	0.208 333	0	0.000 000
1	.000 694	.042 361	.084 028	.125 694	.167 361	.209 028	1	.000 012
2	.001 389	.043 056	.084 722	.126 389	.168 056	.209 722	2	.000 023
3	.002 083	.043 750	.085 417	.127 083	.168 750	.210 417	3	.000 035
4	.002 778	.044 444	.086 111	.127 778	.169 444	.211 111	4	.000 046
5	0.003 472	0.045 139	0.086 806	0.128 472	0.170 139	0.211 806	5	0.000 058
6	.004 167	.045 833	.087 500	.129 167	.170 833	.212 500	6	.000 069
7	.004 861	.046 528	.088 194	.129 861	.171 528	.213 194	7	.000 081
8	.005 556	.047 222	.088 889	.130 556	.172 222	.213 889	8	.000 093
9	.006 250	.047 917	.089 583	.131 250	.172 917	.214 583	9	.000 104
10	0.006 944	0.048 611	0.090 278	0.131 944	0.173 611	0.215 278	10	0.000 116
11	.007 639	.049 306	.090 972	.132 639	.174 306	.215 972	11	.000 127
12	.008 333	.050 000	.091 667	.133 333	.175 000	.216 667	12	.000 139
13	.009 028	.050 694	.092 361	.134 028	.175 694	.217 361	13	.000 150
14	.009 722	.051 389	.093 056	.134 722	.176 389	.218 056	14	.000 162
15	0.010 417	0.052 083	0.093 750	0.135 417	0.177 083	0.218 750	15	0.000 174
16	.011 111	.052 778	.094 444	.136 111	.177 778	.219 444	16	.000 185
17	.011 806	.053 472	.095 139	.136 806	.178 472	.220 139	17	.000 197
18	.012 500	.054 167	.095 833	.137 500	.179 167	.220 833	18	.000 208
19	.013 194	.054 861	.096 528	.138 194	.179 861	.221 528	19	.000 220
20	0.013 889	0.055 556	0.097 222	0.138 889	0.180 556	0.222 222	20	0.000 231
21	.014 583	.056 250	.097 917	.139 583	.181 250	.222 917	21	.000 243
22	.015 278	.056 944	.098 611	.140 278	.181 944	.223 611	22	.000 255
23	.015 972	.057 639	.099 306	.140 972	.182 639	.224 306	23	.000 266
24	.016 667	.058 333	.100 000	.141 667	.183 333	.225 000	24	.000 278
25	0.017 361	0.059 028	0.100 694	0.142 361	0.184 028	0.225 694	25	0.000 289
26	.018 056	.059 722	.101 389	.143 056	.184 722	.226 389	26	.000 301
27	.018 750	.060 417	.102 083	.143 750	.185 417	.227 083	27	.000 312
28	.019 444	.061 111	.102 778	.144 444	.186 111	.227 778	28	.000 324
29	.020 139	.061 806	.103 472	.145 139	.186 806	.228 472	29	.000 336
30	0.020 833	0.062 500	0.104 167	0.145 833	0.187 500	0.229 167	30	0.000 347
31	.021 528	.063 194	.104 861	.146 528	.188 194	.229 861	31	.000 359
32	.022 222	.063 889	.105 556	.147 222	.188 889	.230 556	32	.000 370
33	.022 917	.064 583	.106 250	.147 917	.189 583	.231 250	33	.000 382
34	.023 611	.065 278	.106 944	.148 611	.190 278	.231 944	34	.000 394
35	0.024 306	0.065 972	0.107 639	0.149 306	0.190 972	0.232 639	35	0.000 405
36	.025 000	.066 667	.108 333	.150 000	.191 667	.233 333	36	.000 417
37	.025 694	.067 361	.109 028	.150 694	.192 361	.234 028	37	.000 428
38	.026 389	.068 056	.109 722	.151 389	.193 056	.234 722	38	.000 440
39	.027 083	.068 750	.110 417	.152 083	.193 750	.235 417	39	.000 451
40	0.027 778	0.069 444	0.111 111	0.152 778	0.194 444	0.236 111	40	0.000 463
41	.028 472	.070 139	.111 806	.153 472	.195 139	.236 806	41	.000 475
42	.029 167	.070 833	.112 500	.154 167	.195 833	.237 500	42	.000 486
43	.029 861	.071 528	.113 194	.154 861	.196 528	.238 194	43	.000 498
44	.030 556	.072 222	.113 889	.155 556	.197 222	.238 889	44	.000 509
45	0.031 250	0.072 917	0.114 583	0.156 250	0.197 917	0.239 583	45	0.000 521
46	.031 944	.073 611	.115 278	.156 944	.198 611	.240 278	46	.000 532
47	.032 639	.074 306	.115 972	.157 639	.199 306	.240 972	47	.000 544
48	.033 333	.075 000	.116 667	.158 333	.200 000	.241 667	48	.000 556
49	.034 028	.075 694	.117 361	.159 028	.200 694	.242 361	49	.000 567
50	0.034 722	0.076 389	0.118 056	0.159 722	0.201 389	0.243 056	50	0.000 579
51	.035 417	.077 083	.118 750	.160 417	.202 083	.243 750	51	.000 590
52	.036 111	.077 778	.119 444	.161 111	.202 778	.244 444	52	.000 602
53	.036 806	.078 472	.120 139	.161 806	.203 472	.245 139	53	.000 613
54	.037 500	.079 167	.120 833	.162 500	.204 167	.245 833	54	.000 625
55	0.038 194	0.079 861	0.121 528	0.163 194	0.204 861	0.246 528	55	0.000 637
56	.038 889	.080 556	.122 222	.163 889	.205 556	.247 222	56	.000 648
57	.039 583	.081 250	.122 917	.164 583	.206 250	.247 917	57	.000 660
58	.040 278	.081 944	.123 611	.165 278	.206 944	.248 611	58	.000 671
59	0.040 972	0.082 639	0.124 306	0.165 972	0.207 639	0.249 306	59	0.000 683

CONVERSION OF HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

	6 ^h	7 ^h	8 ^h	9 ^h	10 ^h	11 ^h	SECONDS	
m	d	d	d	d	d	d	s	d
0	0.250 000	0.291 667	0.333 333	0.375 000	0.416 667	0.458 333	0	0.000 000
1	.250 694	.292 361	.334 028	.375 694	.417 361	.459 028	1	.000 012
2	.251 389	.293 056	.334 722	.376 389	.418 056	.459 722	2	.000 023
3	.252 083	.293 750	.335 417	.377 083	.418 750	.460 417	3	.000 035
4	.252 778	.294 444	.336 111	.377 778	.419 444	.461 111	4	.000 046
5	0.253 472	0.295 139	0.336 806	0.378 472	0.420 139	0.461 806	5	0.000 058
6	.254 167	.295 833	.337 500	.379 167	.420 833	.462 500	6	.000 069
7	.254 861	.296 528	.338 194	.379 861	.421 528	.463 194	7	.000 081
8	.255 556	.297 222	.338 889	.380 556	.422 222	.463 889	8	.000 093
9	.256 250	.297 917	.339 583	.381 250	.422 917	.464 583	9	.000 104
10	0.256 944	0.298 611	0.340 278	0.381 944	0.423 611	0.465 278	10	0.000 116
11	.257 639	.299 306	.340 972	.382 639	.424 306	.465 972	11	.000 127
12	.258 333	.300 000	.341 667	.383 333	.425 000	.466 667	12	.000 139
13	.259 028	.300 694	.342 361	.384 028	.425 694	.467 361	13	.000 150
14	.259 722	.301 389	.343 056	.384 722	.426 389	.468 056	14	.000 162
15	0.260 417	0.302 083	0.343 750	0.385 417	0.427 083	0.468 750	15	0.000 174
16	.261 111	.302 778	.344 444	.386 111	.427 778	.469 444	16	.000 185
17	.261 806	.303 472	.345 139	.386 806	.428 472	.470 139	17	.000 197
18	.262 500	.304 167	.345 833	.387 500	.429 167	.470 833	18	.000 208
19	.263 194	.304 861	.346 528	.388 194	.429 861	.471 528	19	.000 220
20	0.263 889	0.305 556	0.347 222	0.388 889	0.430 556	0.472 222	20	0.000 231
21	.264 583	.306 250	.347 917	.389 583	.431 250	.472 917	21	.000 243
22	.265 278	.306 944	.348 611	.390 278	.431 944	.473 611	22	.000 255
23	.265 972	.307 639	.349 306	.390 972	.432 639	.474 306	23	.000 266
24	.266 667	.308 333	.350 000	.391 667	.433 333	.475 000	24	.000 278
25	0.267 361	0.309 028	0.350 694	0.392 361	0.434 028	0.475 694	25	0.000 289
26	.268 056	.309 722	.351 389	.393 056	.434 722	.476 389	26	.000 301
27	.268 750	.310 417	.352 083	.393 750	.435 417	.477 083	27	.000 312
28	.269 444	.311 111	.352 778	.394 444	.436 111	.477 778	28	.000 324
29	.270 139	.311 806	.353 472	.395 139	.436 806	.478 472	29	.000 336
30	0.270 833	0.312 500	0.354 167	0.395 833	0.437 500	0.479 167	30	0.000 347
31	.271 528	.313 194	.354 861	.396 528	.438 194	.479 861	31	.000 359
32	.272 222	.313 889	.355 556	.397 222	.438 889	.480 556	32	.000 370
33	.272 917	.314 583	.356 250	.397 917	.439 583	.481 250	33	.000 382
34	.273 611	.315 278	.356 944	.398 611	.440 278	.481 944	34	.000 394
35	0.274 306	0.315 972	0.357 639	0.399 306	0.440 972	0.482 639	35	0.000 405
36	.275 000	.316 667	.358 333	.400 000	.441 667	.483 333	36	.000 417
37	.275 694	.317 361	.359 028	.400 694	.442 361	.484 028	37	.000 428
38	.276 389	.318 056	.359 722	.401 389	.443 056	.484 722	38	.000 440
39	.277 083	.318 750	.360 417	.402 083	.443 750	.485 417	39	.000 451
40	0.277 778	0.319 444	0.361 111	0.402 778	0.444 444	0.486 111	40	0.000 463
41	.278 472	.320 139	.361 806	.403 472	.445 139	.486 806	41	.000 475
42	.279 167	.320 833	.362 500	.404 167	.445 833	.487 500	42	.000 486
43	.279 861	.321 528	.363 194	.404 861	.446 528	.488 194	43	.000 498
44	.280 556	.322 222	.363 889	.405 556	.447 222	.488 889	44	.000 509
45	0.281 250	0.322 917	0.364 583	0.406 250	0.447 917	0.489 583	45	0.000 521
46	.281 944	.323 611	.365 278	.406 944	.448 611	.490 278	46	.000 532
47	.282 639	.324 306	.365 972	.407 639	.449 306	.490 972	47	.000 544
48	.283 333	.325 000	.366 667	.408 333	.450 000	.491 667	48	.000 556
49	.284 028	.325 694	.367 361	.409 028	.450 694	.492 361	49	.000 567
50	0.284 722	0.326 389	0.368 056	0.409 722	0.451 389	0.493 056	50	0.000 579
51	.285 417	.327 083	.368 750	.410 417	.452 083	.493 750	51	.000 590
52	.286 111	.327 778	.369 444	.411 111	.452 778	.494 444	52	.000 602
53	.286 806	.328 472	.370 139	.411 806	.453 472	.495 139	53	.000 613
54	.287 500	.329 167	.370 833	.412 500	.454 167	.495 833	54	.000 625
55	0.288 194	0.329 861	0.371 528	0.413 194	0.454 861	0.496 528	55	0.000 637
56	.288 889	.330 556	.372 222	.413 889	.455 556	.497 222	56	.000 648
57	.289 583	.331 250	.372 917	.414 583	.456 250	.497 917	57	.000 660
58	.290 278	.331 944	.373 611	.415 278	.456 944	.498 611	58	.000 671
59	0.290 972	0.332 639	0.374 306	0.415 972	0.457 639	0.499 306	59	0.000 683

TABLE XI
CONVERSION OF TIME TO ARC

m	0 ^h		1 ^h		2 ^h		3 ^h		4 ^h		5 ^h		SECONDS					
	°	'	°	'	°	'	°	'	°	'	°	'	s	'	°	'	s	'
0	0 00		15 00		30 00		45 00		60 00		75 00		0	0 00	0.00	0.00	0.50	7.50
1	0 15		15 15		30 15		45 15		60 15		75 15		1	0 15	.01	0.15	.51	7.65
2	0 30		15 30		30 30		45 30		60 30		75 30		2	0 30	.02	0.30	.52	7.80
3	0 45		15 45		30 45		45 45		60 45		75 45		3	0 45	.03	0.45	.53	7.95
4	1 00		16 00		31 00		46 00		61 00		76 00		4	1 00	.04	0.60	.54	8.10
5	1 15		16 15		31 15		46 15		61 15		76 15		5	1 15	0.05	0.75	0.55	8.25
6	1 30		16 30		31 30		46 30		61 30		76 30		6	1 30	.06	0.90	.56	8.40
7	1 45		16 45		31 45		46 45		61 45		76 45		7	1 45	.07	1.05	.57	8.55
8	2 00		17 00		32 00		47 00		62 00		77 00		8	2 00	.08	1.20	.58	8.70
9	2 15		17 15		32 15		47 15		62 15		77 15		9	2 15	.09	1.35	.59	8.85
10	2 30		17 30		32 30		47 30		62 30		77 30		10	2 30	0.10	1.50	0.60	9.00
11	2 45		17 45		32 45		47 45		62 45		77 45		11	2 45	.11	1.65	.61	9.15
12	3 00		18 00		33 00		48 00		63 00		78 00		12	3 00	.12	1.80	.62	9.30
13	3 15		18 15		33 15		48 15		63 15		78 15		13	3 15	.13	1.95	.63	9.45
14	3 30		18 30		33 30		48 30		63 30		78 30		14	3 30	.14	2.10	.64	9.60
15	3 45		18 45		33 45		48 45		63 45		78 45		15	3 45	0.15	2.25	0.65	9.75
16	4 00		19 00		34 00		49 00		64 00		79 00		16	4 00	.16	2.40	.66	9.90
17	4 15		19 15		34 15		49 15		64 15		79 15		17	4 15	.17	2.55	.67	10.05
18	4 30		19 30		34 30		49 30		64 30		79 30		18	4 30	.18	2.70	.68	10.20
19	4 45		19 45		34 45		49 45		64 45		79 45		19	4 45	.19	2.85	.69	10.35
20	5 00		20 00		35 00		50 00		65 00		80 00		20	5 00	0.20	3.00	0.70	10.50
21	5 15		20 15		35 15		50 15		65 15		80 15		21	5 15	.21	3.15	.71	10.65
22	5 30		20 30		35 30		50 30		65 30		80 30		22	5 30	.22	3.30	.72	10.80
23	5 45		20 45		35 45		50 45		65 45		80 45		23	5 45	.23	3.45	.73	10.95
24	6 00		21 00		36 00		51 00		66 00		81 00		24	6 00	.24	3.60	.74	11.10
25	6 15		21 15		36 15		51 15		66 15		81 15		25	6 15	0.25	3.75	0.75	11.25
26	6 30		21 30		36 30		51 30		66 30		81 30		26	6 30	.26	3.90	.76	11.40
27	6 45		21 45		36 45		51 45		66 45		81 45		27	6 45	.27	4.05	.77	11.55
28	7 00		22 00		37 00		52 00		67 00		82 00		28	7 00	.28	4.20	.78	11.70
29	7 15		22 15		37 15		52 15		67 15		82 15		29	7 15	.29	4.35	.79	11.85
30	7 30		22 30		37 30		52 30		67 30		82 30		30	7 30	0.30	4.50	0.80	12.00
31	7 45		22 45		37 45		52 45		67 45		82 45		31	7 45	.31	4.65	.81	12.15
32	8 00		23 00		38 00		53 00		68 00		83 00		32	8 00	.32	4.80	.82	12.30
33	8 15		23 15		38 15		53 15		68 15		83 15		33	8 15	.33	4.95	.83	12.45
34	8 30		23 30		38 30		53 30		68 30		83 30		34	8 30	.34	5.10	.84	12.60
35	8 45		23 45		38 45		53 45		68 45		83 45		35	8 45	0.35	5.25	0.85	12.75
36	9 00		24 00		39 00		54 00		69 00		84 00		36	9 00	.36	5.40	.86	12.90
37	9 15		24 15		39 15		54 15		69 15		84 15		37	9 15	.37	5.55	.87	13.05
38	9 30		24 30		39 30		54 30		69 30		84 30		38	9 30	.38	5.70	.88	13.20
39	9 45		24 45		39 45		54 45		69 45		84 45		39	9 45	.39	5.85	.89	13.35
40	10 00		25 00		40 00		55 00		70 00		85 00		40	10 00	0.40	6.00	0.90	13.50
41	10 15		25 15		40 15		55 15		70 15		85 15		41	10 15	.41	6.15	.91	13.65
42	10 30		25 30		40 30		55 30		70 30		85 30		42	10 30	.42	6.30	.92	13.80
43	10 45		25 45		40 45		55 45		70 45		85 45		43	10 45	.43	6.45	.93	13.95
44	11 00		26 00		41 00		56 00		71 00		86 00		44	11 00	.44	6.60	.94	14.10
45	11 15		26 15		41 15		56 15		71 15		86 15		45	11 15	0.45	6.75	0.95	14.25
46	11 30		26 30		41 30		56 30		71 30		86 30		46	11 30	.46	6.90	.96	14.40
47	11 45		26 45		41 45		56 45		71 45		86 45		47	11 45	.47	7.05	.97	14.55
48	12 00		27 00		42 00		57 00		72 00		87 00		48	12 00	.48	7.20	.98	14.70
49	12 15		27 15		42 15		57 15		72 15		87 15		49	12 15	.49	7.35	0.99	14.85
50	12 30		27 30		42 30		57 30		72 30		87 30		50	12 30	0.50	7.50	1.00	15.00
51	12 45		27 45		42 45		57 45		72 45		87 45		51	12 45				
52	13 00		28 00		43 00		58 00		73 00		88 00		52	13 00				
53	13 15		28 15		43 15		58 15		73 15		88 15		53	13 15				
54	13 30		28 30		43 30		58 30		73 30		88 30		54	13 30				
55	13 45		28 45		43 45		58 45		73 45		88 45		55	13 45				
56	14 00		29 00		44 00		59 00		74 00		89 00		56	14 00				
57	14 15		29 15		44 15		59 15		74 15		89 15		57	14 15				
58	14 30		29 30		44 30		59 30		74 30		89 30		58	14 30				
59	14 45		29 45		44 45		59 45		74 45		89 45		59	14 45				

6^h = 90°

12^h = 180°

18^h = 270°

CONVERSION OF ARC TO TIME

DEGREES						MINUTES			SECONDS					
°	h	m	°	h	m	°	h	m	°	s	°	s	°	s
0	0	00	60	4	00	120	8	00	0	0 00	0	0.000	0.00	0.000
1	0	04	61	4	04	121	8	04	1	0 04	1	0.067	.01	.001
2	0	08	62	4	08	122	8	08	2	0 08	2	0.133	.02	.001
3	0	12	63	4	12	123	8	12	3	0 12	3	0.200	.03	.002
4	0	16	64	4	16	124	8	16	4	0 16	4	0.267	.04	.003
5	0	20	65	4	20	125	8	20	5	0 20	5	0.333	0.05	0.003
6	0	24	66	4	24	126	8	24	6	0 24	6	0.400	.06	.004
7	0	28	67	4	28	127	8	28	7	0 28	7	0.467	.07	.005
8	0	32	68	4	32	128	8	32	8	0 32	8	0.533	.08	.005
9	0	36	69	4	36	129	8	36	9	0 36	9	0.600	.09	.006
10	0	40	70	4	40	130	8	40	10	0 40	10	0.667	0.10	0.007
11	0	44	71	4	44	131	8	44	11	0 44	11	0.733	.11	.007
12	0	48	72	4	48	132	8	48	12	0 48	12	0.800	.12	.008
13	0	52	73	4	52	133	8	52	13	0 52	13	0.867	.13	.009
14	0	56	74	4	56	134	8	56	14	0 56	14	0.933	.14	.009
15	1	00	75	5	00	135	9	00	15	1 00	15	1.000	0.15	0.010
16	1	04	76	5	04	136	9	04	16	1 04	16	1.067	.16	.011
17	1	08	77	5	08	137	9	08	17	1 08	17	1.133	.17	.011
18	1	12	78	5	12	138	9	12	18	1 12	18	1.200	.18	.012
19	1	16	79	5	16	139	9	16	19	1 16	19	1.267	.19	.013
20	1	20	80	5	20	140	9	20	20	1 20	20	1.333	0.20	0.013
21	1	24	81	5	24	141	9	24	21	1 24	21	1.400	.21	.014
22	1	28	82	5	28	142	9	28	22	1 28	22	1.467	.22	.015
23	1	32	83	5	32	143	9	32	23	1 32	23	1.533	.23	.015
24	1	36	84	5	36	144	9	36	24	1 36	24	1.600	.24	.016
25	1	40	85	5	40	145	9	40	25	1 40	25	1.667	0.25	0.017
26	1	44	86	5	44	146	9	44	26	1 44	26	1.733	.26	.017
27	1	48	87	5	48	147	9	48	27	1 48	27	1.800	.27	.018
28	1	52	88	5	52	148	9	52	28	1 52	28	1.867	.28	.019
29	1	56	89	5	56	149	9	56	29	1 56	29	1.933	.29	.019
30	2	00	90	6	00	150	10	00	30	2 00	30	2.000	0.30	0.020
31	2	04	91	6	04	151	10	04	31	2 04	31	2.067	.31	.021
32	2	08	92	6	08	152	10	08	32	2 08	32	2.133	.32	.021
33	2	12	93	6	12	153	10	12	33	2 12	33	2.200	.33	.022
34	2	16	94	6	16	154	10	16	34	2 16	34	2.267	.34	.023
35	2	20	95	6	20	155	10	20	35	2 20	35	2.333	0.35	0.023
36	2	24	96	6	24	156	10	24	36	2 24	36	2.400	.36	.024
37	2	28	97	6	28	157	10	28	37	2 28	37	2.467	.37	.025
38	2	32	98	6	32	158	10	32	38	2 32	38	2.533	.38	.025
39	2	36	99	6	36	159	10	36	39	2 36	39	2.600	.39	.026
40	2	40	100	6	40	160	10	40	40	2 40	40	2.667	0.40	0.027
41	2	44	101	6	44	161	10	44	41	2 44	41	2.733	.41	.027
42	2	48	102	6	48	162	10	48	42	2 48	42	2.800	.42	.028
43	2	52	103	6	52	163	10	52	43	2 52	43	2.867	.43	.029
44	2	56	104	6	56	164	10	56	44	2 56	44	2.933	.44	.029
45	3	00	105	7	00	165	11	00	45	3 00	45	3.000	0.45	0.030
46	3	04	106	7	04	166	11	04	46	3 04	46	3.067	.46	.031
47	3	08	107	7	08	167	11	08	47	3 08	47	3.133	.47	.031
48	3	12	108	7	12	168	11	12	48	3 12	48	3.200	.48	.032
49	3	16	109	7	16	169	11	16	49	3 16	49	3.267	.49	.033
50	3	20	110	7	20	170	11	20	50	3 20	50	3.333	0.50	0.033
51	3	24	111	7	24	171	11	24	51	3 24	51	3.400		
52	3	28	112	7	28	172	11	28	52	3 28	52	3.467		
53	3	32	113	7	32	173	11	32	53	3 32	53	3.533		
54	3	36	114	7	36	174	11	36	54	3 36	54	3.600		
55	3	40	115	7	40	175	11	40	55	3 40	55	3.667		
56	3	44	116	7	44	176	11	44	56	3 44	56	3.733		
57	3	48	117	7	48	177	11	48	57	3 48	57	3.800		
58	3	52	118	7	52	178	11	52	58	3 52	58	3.867		
59	3	56	119	7	56	179	11	56	59	3 56	59	3.933		

90° = 6^h180° = 12^h270° = 18^h

NOTATION

Arg. Function		Differences				
		1st	2nd	3rd	4th	$f(t_p)=f(t_0+ph)=f_p$
						$\delta_p=f_{p+\frac{1}{2}}-f_{p-\frac{1}{2}} \quad \delta_p^2=\delta(\delta_p)$
t_{-2}	f_{-2}					$\delta_{\frac{1}{2}}=f_1-f_0 \quad \delta_0^2+\delta_1^2=\delta_{1\frac{1}{2}}-\delta_{-\frac{1}{2}}$
t_{-1}	f_{-1}	$\delta_{-1\frac{1}{2}}$	δ_{-1}^2			$\delta_0^2=\delta_{\frac{1}{2}}-\delta_{-\frac{1}{2}}=f_1-2f_0+f_{-1}$
t_0	f_0	$\delta_{-\frac{1}{2}}$	δ_0^2	$\delta_{-\frac{3}{2}}^3$	δ_0^4	$\delta_{\frac{3}{2}}^3=\delta_1^2-\delta_0^2=f_2-3f_1+3f_0-f_{-1}$
t_1	f_1	$\delta_{\frac{1}{2}}$	δ_1^2	$\delta_{\frac{3}{2}}^3$		$\delta_0^4=\delta_{\frac{3}{2}}^3-\delta_{-\frac{3}{2}}^3=f_2-4f_1+6f_0-4f_{-1}+f_{-2}$
t_2	f_2	$\delta_{1\frac{1}{2}}$				

BESSEL'S INTERPOLATION FORMULA

$f_p=f_0+p\delta_{\frac{1}{2}}+B_2(\delta_0^2+\delta_1^2)+B_3\delta_{\frac{3}{2}}^3+B_4(\delta_0^4+\delta_1^4)+\dots$

The maximum truncation error of the interpolate f_p from neglecting each order of difference is less than 0.5 in the unit of the end figure of the tabular function if

$\delta^2 < 4 \quad \delta^3 < 60 \quad \delta^4 < 20 \quad \delta^5 < 500$

If δ^2 is replaced by $\delta_m^2=\delta^2-0.184 \delta^4$, the corresponding limit for δ^4 is raised to 1000; $\delta_{\frac{3}{2}}^3$ may be replaced by $\delta_{m1}^2-\delta_{m0}^2$.

PRECEPTS FOR USING THE TABLES

Table XIII. Round the interpolating factor p to 4 decimals; the required value of B_2 is the tabular value opposite the interval in which p lies or, if p exactly equals a tabular argument, the value above and to the right of p . The effects of third and fourth differences can be estimated from the values of B_3 and B_4 in the last column.

Table XIV. The table is entered with the tabular arguments nearest the true values of p and $\delta_0^2+\delta_1^2$, to obtain directly the value of the second-difference correction; this correction always has the opposite sign to $\delta_0^2+\delta_1^2$.

Table XV. The value of B_2 may be obtained by mental linear interpolation since the first difference of B_2 is never greater than 4. The corrections for third and fourth differences, which are usually necessary when Table XIII cannot be used, are taken from the Tables XVI and XVII; these tables are similar to Table XIV, but include a guarding decimal, and require mental interpolation for some ranges of the argument, to reduce the error of the interpolate.

Errors. In addition to the truncation error, an interpolate is subject to errors from the following sources:

		Maximum error
$f_0+p\delta_{\frac{1}{2}}$	Rounding errors in f_0, f_1	0.5
$B_2(\delta_0^2+\delta_1^2)+B_3\delta_{\frac{3}{2}}^3+\dots$	Rounding errors in tabular values	0.2
$B_2(\delta_0^2+\delta_1^2)$	Rounding error of B_2 from Table XIII	0.00051($\delta_0^2-\delta_1^2$)
$B_2(\delta_0^2+\delta_1^2)$	Table XIV, using nearest arguments	0.7
$B_2(\delta_0^2+\delta_1^2)$	Error of B_2 from Table XV	0.00011($\delta_0^2-\delta_1^2$)
$B_3\delta_{\frac{3}{2}}^3+B_4(\delta_0^4+\delta_1^4)$	Tables XVI and XVII, with mental interpolation	0.3
f_p	Final rounding error	0.5

EXAMPLES

To find (a) the right ascension of the Sun, and (b) the horizontal parallax of the Moon, at 16^h 23^m 15^s.8 E. T., on 1967 October 11. The tabular values, and their differences in units of the end figure of the functions, are:

1967	R.A. of Sun	δ	δ^2	1967	H.P. of Moon	δ	δ^2	δ^3	δ^4
Oct.	h m s			Oct.	' "				
10.0	12 58 57.39	+22046	+44	11.0	57 07.784	-23038	+1185	+191	-73
11.0	13 02 37.85	+22091	+45	11.5	56 44.746	-21662	+1376	+131	-60
12.0	13 06 18.76	+22138	+47	12.0	56 23.084	-20155	+1507	+78	-53
13.0	13 10 00.14		+48	12.5	56 02.929		+1585		-45

(a) The tabular interval is one day; the interpolating factor p is therefore 0.68282. From Table XIII, $B_2 = -0.054$; and

$$f_p = 13^h 02^m 37^s.85 + 0.68282(+220^s.91) - 0.054(+0^s.45 + 0^s.47) = 13^h 05^m 08^s.64$$

Alternatively, from Table XIV, with arguments $p = 0.68$, $\delta_0^2 + \delta_1^2 = 90$, the second-difference correction $B_2(\delta_0^2 + \delta_1^2) = -5$; and

$$f_p = 13^h 02^m 37^s.85 + 0.68282(+220^s.91) - 0^s.05 = 13^h 05^m 08^s.64$$

(b) The tabular interval is 0^s.5; the interpolating factor p is therefore 0.36564. From Table XV, $B_2 = -0.0580$; from Table XVI, $B_3\delta_2^3 = +0.7$, using $p = 0.366$, $\delta_2^3 = 131$; from Table XVII, $B_4(\delta_0^4 + \delta_1^4) = -1.2$, using $p = 0.366$, $\delta_0^4 + \delta_1^4 = 113$; and

$$f_p = 56' 44'' 746 + 0.36564(-21'' 662) - 0.0580(+1'' 376 + 1'' 507) + 0'' 0007 - 0'' 0012 = 56' 36'' 658$$

TABLE XIII. BESSEL COEFFICIENTS B_2, B_3, B_4

p	B_2	p	B_2	p	B_2	p	B_2	p	B_2	p	B_3
0.0000	.000	0.1101	.025	0.2719	.050	0.7280	.049	0.8898	.024	0.0	0.000
.0020	.001	.1152	.026	.2809	.051	.7366	.048	.8949	.023	.1	+ .006
.0060	.001	.1205	.026	.2902	.051	.7449	.048	.9000	.023	.2	.008
.0101	.002	.1258	.027	.3000	.052	.7529	.047	.9049	.022	.3	.007
.0142	.003	.1312	.028	.3102	.053	.7607	.046	.9098	.021	.4	+ .004
.0183	.004	.1366	.029	.3211	.054	.7683	.045	.9147	.020		
.0225	.005	.1422	.030	.3326	.055	.7756	.044	.9195	.019	0.5	0.000
.0267	.006	.1478	.031	.3450	.056	.7828	.043	.9242	.018	.6	- .004
.0309	.007	.1535	.032	.3585	.057	.7898	.042	.9289	.017	.7	.007
.0352	.008	.1594	.033	.3735	.058	.7966	.041	.9335	.016	.8	.008
.0395	.009	.1653	.034	.3904	.059	.8033	.040	.9381	.015	.9	- .006
.0439	.010	.1713	.035	.4105	.060	.8098	.039	.9427	.014	1.0	0.000
.0483	.011	.1775	.036	.4367	.061	.8162	.038	.9472	.013		
.0527	.012	.1837	.037	.5632	.062	.8224	.037	.9516	.012	p	B_4
.0572	.013	.1901	.038	.5894	.061	.8286	.036	.9560	.011	0.0	0.000
.0618	.014	.1966	.039	.6095	.060	.8346	.035	.9604	.010	.1	+ .004
.0664	.015	.2033	.040	.6264	.059	.8405	.034	.9647	.009	.2	.007
.0710	.016	.2101	.041	.6414	.058	.8464	.033	.9690	.008	.3	.010
.0757	.017	.2171	.042	.6549	.057	.8521	.032	.9732	.007	.4	.011
.0804	.018	.2243	.043	.6673	.056	.8577	.031	.9774	.006		
.0852	.019	.2316	.044	.6788	.055	.8633	.030	.9816	.005	0.5	+0.012
.0901	.020	.2392	.045	.6897	.054	.8687	.029	.9857	.004	.6	.011
.0950	.021	.2470	.046	.7000	.053	.8741	.028	.9898	.003	.7	.010
.1000	.022	.2550	.047	.7097	.052	.8794	.027	.9939	.002	.8	.007
.1050	.023	.2633	.048	.7190	.051	.8847	.026	.9979	.001	.9	+ .004
0.1101	.024	0.2719	.049	0.7280	.050	0.8898	.025	1.0000	.000	1.0	0.000

In critical cases ascend.
 B_2 is always negative.

TABLE XIV. SECOND-DIFFERENCE CORRECTION $B_2(\delta_0^2 + \delta_1^2)$

p	Double second difference $\delta_0^2 + \delta_1^2$																					p
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99
.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	.98
.03	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	.97
.04	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	.96
0.05	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0.95
.06	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	2	.94
.07	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	.93
.08	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	.92
.09	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	.91
0.10	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	0.90
.11	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	.89
.12	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	.88
.13	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	.87
.14	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	.86
0.15	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	0.85
.16	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	.84
.17	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	.83
.18	0	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	.82
.19	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	.81
0.20	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	0.80
.21	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	5	.79
.22	0	1	1	1	1	2	2	2	2	2	2	3	3	3	3	4	4	4	4	5	5	.78
.23	0	1	1	1	1	2	2	2	2	2	2	3	3	3	4	4	4	4	4	5	5	.77
.24	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	.76
0.25	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	0.75
.26	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	.74
.27	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	.73
.28	1	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	5	6	.72
.29	1	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	5	6	.71
0.30	1	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	5	5	6	6	0.70
.31	1	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	.69
.32	1	1	1	1	1	2	2	2	2	2	3	3	4	4	4	4	5	5	5	6	6	.68
.33	1	1	1	1	1	2	2	2	2	2	3	3	4	4	4	4	5	5	5	6	6	.67
.34	1	1	1	1	1	2	2	2	2	3	3	3	4	4	4	4	5	5	5	6	6	.66
0.35	1	1	1	1	1	2	2	2	2	3	3	3	4	4	4	5	5	5	5	6	6	0.65
.36	1	1	1	1	1	2	2	2	2	3	3	3	4	4	4	5	5	5	5	6	6	.64
.37	1	1	1	1	1	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	.63
.38	1	1	1	1	1	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	.62
.39	1	1	1	1	1	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.61
0.40	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	0.60
.41	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.59
.42	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.58
.43	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.57
.44	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.56
0.45	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	0.55
.46	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.54
.47	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.53
.48	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.52
.49	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	.51
0.50	1	1	1	1	2	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	7	0.50

The correction has the opposite sign to $\delta_0^2 + \delta_1^2$.

TABLE XIV. SECOND-DIFFERENCE CORRECTION $B_2(\delta_0^2 + \delta_1^2)$

p	Double second difference $\delta_0^2 + \delta_1^2$																		p
	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	
0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00
.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99
.02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.98
.03	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.97
.04	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	.96
0.05	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0.95
.06	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	.94
.07	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	.93
.08	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4	.92
.09	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	.91
0.10	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	0.90
.11	3	3	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	.89
.12	3	3	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5	5	.88
.13	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	5	6	6	.87
.14	3	4	4	4	4	4	4	5	5	5	5	5	5	5	6	6	6	6	.86
0.15	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	0.85
.16	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	7	7	.84
.17	4	4	4	5	5	5	5	5	5	6	6	6	6	6	7	7	7	7	.83
.18	4	4	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	.82
.19	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	.81
0.20	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	0.80
.21	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	.79
.22	5	5	5	6	6	6	6	6	6	7	7	7	8	8	8	8	8	9	.78
.23	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	.77
.24	5	5	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	.76
0.25	5	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	0.75
.26	6	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	.74
.27	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	.73
.28	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	.72
.29	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	.71
0.30	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	0.70
.31	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	11	.69
.32	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	.68
.33	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	.67
.34	6	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	.66
0.35	7	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	11	0.65
.36	7	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	.64
.37	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	.63
.38	7	7	7	8	8	8	9	9	9	9	10	10	10	11	11	11	11	12	.62
.39	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	11	12	.61
0.40	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	11	12	0.60
.41	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	11	12	.59
.42	7	7	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	.58
.43	7	7	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	.57
.44	7	7	8	8	8	9	9	9	10	10	10	10	10	11	11	11	12	12	.56
0.45	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	0.55
.46	7	7	8	8	8	9	9	9	10	10	10	11	11	11	11	11	12	12	.54
.47	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.53
.48	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.52
.49	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	.51
0.50	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	12	0.50

If third and fourth differences are negligible $f_p = f_0 + p\delta_1 + B_2(\delta_0^2 + \delta_1^2)$.

TABLE XV. SECOND-DIFFERENCE COEFFICIENT B_2

p	B_2	p	p	B_2	p	p	B_2	p	p	B_2	p
0.000	-0.0000	1.000	0.035	-0.0084	0.965	0.070	-0.0163	0.930	0.105	-0.0235	0.895
.001	.02	.999	.036	.87	.964	.071	.165	.929	.106	.237	.894
.002	.05	.998	.037	.89	.963	.072	.167	.928	.107	.239	.893
.003	.07	.997	.038	.91	.962	.073	.169	.927	.108	.241	.892
.004	.10	.996	.039	.94	.961	.074	.171	.926	.109	.243	.891
0.005	-0.0012	0.995	0.040	-0.0096	0.960	0.075	-0.0173	0.925	0.110	-0.0245	0.890
.006	.15	.994	.041	.098	.959	.076	.176	.924	.111	.247	.889
.007	.17	.993	.042	.101	.958	.077	.178	.923	.112	.249	.888
.008	.20	.992	.043	.103	.957	.078	.180	.922	.113	.251	.887
.009	.22	.991	.044	.105	.956	.079	.182	.921	.114	.253	.886
0.010	-0.0025	0.990	0.045	-0.0107	0.955	0.080	-0.0184	0.920	0.115	-0.0254	0.885
.011	.27	.989	.046	.110	.954	.081	.186	.919	.116	.256	.884
.012	.30	.988	.047	.112	.953	.082	.188	.918	.117	.258	.883
.013	.32	.987	.048	.114	.952	.083	.190	.917	.118	.260	.882
.014	.35	.986	.049	.116	.951	.084	.192	.916	.119	.262	.881
0.015	-0.0037	0.985	0.050	-0.0119	0.950	0.085	-0.0194	0.915	0.120	-0.0264	0.880
.016	.39	.984	.051	.121	.949	.086	.197	.914	.121	.266	.879
.017	.42	.983	.052	.123	.948	.087	.199	.913	.122	.268	.878
.018	.44	.982	.053	.125	.947	.088	.201	.912	.123	.270	.877
.019	.47	.981	.054	.128	.946	.089	.203	.911	.124	.272	.876
0.020	-0.0049	0.980	0.055	-0.0130	0.945	0.090	-0.0205	0.910	0.125	-0.0273	0.875
.021	.51	.979	.056	.132	.944	.091	.207	.909	.126	.275	.874
.022	.54	.978	.057	.134	.943	.092	.209	.908	.127	.277	.873
.023	.56	.977	.058	.137	.942	.093	.211	.907	.128	.279	.872
.024	.59	.976	.059	.139	.941	.094	.213	.906	.129	.281	.871
0.025	-0.0061	0.975	0.060	-0.0141	0.940	0.095	-0.0215	0.905	0.130	-0.0283	0.870
.026	.63	.974	.061	.143	.939	.096	.217	.904	.131	.285	.869
.027	.66	.973	.062	.145	.938	.097	.219	.903	.132	.286	.868
.028	.68	.972	.063	.148	.937	.098	.221	.902	.133	.288	.867
.029	.70	.971	.064	.150	.936	.099	.223	.901	.134	.290	.866
0.030	-0.0073	0.970	0.065	-0.0152	0.935	0.100	-0.0225	0.900	0.135	-0.0292	0.865
.031	.75	.969	.066	.154	.934	.101	.227	.899	.136	.294	.864
.032	.77	.968	.067	.156	.933	.102	.229	.898	.137	.296	.863
.033	.80	.967	.068	.158	.932	.103	.231	.897	.138	.297	.862
.034	.82	.966	.069	.161	.931	.104	.233	.896	.139	.299	.861
0.035	-0.0084	0.965	0.070	-0.0163	0.930	0.105	-0.0235	0.895	0.140	-0.0301	0.860

TABLE XVI. THIRD-DIFFERENCE CORRECTION $B_3\delta_{\frac{1}{2}}^3$

Interpolating factor p : correction has same sign as difference $\delta_{\frac{1}{2}}^3$

$\delta_{\frac{1}{2}}^3$	0.00	0.02	0.04	0.06	0.08	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.42	0.44	0.46	0.48	0.50
100	0.0	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.0
200	0.0	0.3	0.6	0.8	1.0	1.2	1.5	1.6	1.6	1.4	1.1	0.8	0.6	0.5	0.3	0.2	0.0
300	0.0	0.5	0.9	1.2	1.5	1.8	2.2	2.4	2.3	2.1	1.7	1.2	1.0	0.7	0.5	0.2	0.0
400	0.0	0.6	1.2	1.7	2.1	2.4	3.0	3.2	3.1	2.8	2.3	1.6	1.3	1.0	0.7	0.3	0.0
500	0.0	0.8	1.5	2.1	2.6	3.0	3.7	4.0	3.9	3.5	2.8	2.0	1.6	1.2	0.8	0.4	0.0
600	0.0	1.0	1.8	2.5	3.1	3.6	4.5	4.8	4.7	4.2	3.4	2.4	1.9	1.5	1.0	0.5	0.0
700	0.0	1.1	2.1	2.9	3.6	4.2	5.2	5.6	5.5	4.9	4.0	2.8	2.3	1.7	1.2	0.6	0.0
800	0.0	1.3	2.4	3.3	4.1	4.8	6.0	6.4	6.2	5.6	4.6	3.2	2.6	2.0	1.3	0.7	0.0
900	0.0	1.4	2.6	3.7	4.6	5.4	6.7	7.2	7.0	6.3	5.1	3.6	2.9	2.2	1.5	0.7	0.0
1000	0.0	1.6	2.9	4.1	5.2	6.0	7.4	8.0	7.8	7.0	5.7	4.0	3.2	2.5	1.7	0.8	0.0
	1.00	0.98	0.96	0.94	0.92	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.58	0.56	0.54	0.52	0.50

Interpolating factor p : correction has opposite sign to difference $\delta_{\frac{1}{2}}^3$

$$f_p = f_o + p\delta_{\frac{1}{2}} + B_2(\delta_o^2 + \delta_1^2) + B_3\delta_{\frac{1}{2}}^3 + B_4(\delta_o^4 + \delta_1^4)$$

TABLE XV. SECOND-DIFFERENCE COEFFICIENT B_2

p	B_2	p	p	B_2	p	p	B_2	p	p	B_2	p
0.140	-0.0301	0.860	0.210	-0.0415	0.790	0.280	-0.0504	0.720	0.350	-0.0569	0.650
.142	.305	.858	.212	.418	.788	.282	.506	.718	.355	.572	.645
.144	.308	.856	.214	.421	.786	.284	.508	.716	.360	.576	.640
.146	.312	.854	.216	.423	.784	.286	.511	.714	.365	.579	.635
.148	.315	.852	.218	.426	.782	.288	.513	.712	.370	.583	.630
0.150	-0.0319	0.850	0.220	-0.0429	0.780	0.290	-0.0515	0.710	0.375	-0.0586	0.625
.152	.322	.848	.222	.432	.778	.292	.517	.708	.380	.589	.620
.154	.326	.846	.224	.435	.776	.294	.519	.706	.385	.592	.615
.156	.329	.844	.226	.437	.774	.296	.521	.704	.390	.595	.610
.158	.333	.842	.228	.440	.772	.298	.523	.702	.395	.597	.605
0.160	-0.0336	0.840	0.230	-0.0443	0.770	0.300	-0.0525	0.700	0.400	-0.0600	0.600
.162	.339	.838	.232	.445	.768	.302	.527	.698	.405	.602	.595
.164	.343	.836	.234	.448	.766	.304	.529	.696	.410	.605	.590
.166	.346	.834	.236	.451	.764	.306	.531	.694	.415	.607	.585
.168	.349	.832	.238	.453	.762	.308	.533	.692	.420	.609	.580
0.170	-0.0353	0.830	0.240	-0.0456	0.760	0.310	-0.0535	0.690	0.425	-0.0611	0.575
.172	.356	.828	.242	.459	.758	.312	.537	.688	.430	.613	.570
.174	.359	.826	.244	.461	.756	.314	.539	.686	.435	.614	.565
.176	.363	.824	.246	.464	.754	.316	.540	.684	.440	.616	.560
.178	.366	.822	.248	.466	.752	.318	.542	.682	.445	.617	.555
0.180	-0.0369	0.820	0.250	-0.0469	0.750	0.320	-0.0544	0.680	0.450	-0.0619	0.550
.182	.372	.818	.252	.471	.748	.322	.546	.678	.455	.620	.545
.184	.375	.816	.254	.474	.746	.324	.548	.676	.460	.621	.540
.186	.379	.814	.256	.476	.744	.326	.549	.674	.465	.622	.535
.188	.382	.812	.258	.479	.742	.328	.551	.672	.470	.623	.530
0.190	-0.0385	0.810	0.260	-0.0481	0.740	0.330	-0.0553	0.670	0.475	-0.0623	0.525
.192	.388	.808	.262	.483	.738	.332	.554	.668	.480	.624	.520
.194	.391	.806	.264	.486	.736	.334	.556	.666	.485	.624	.515
.196	.394	.804	.266	.488	.734	.336	.558	.664	.490	.625	.510
.198	.397	.802	.268	.490	.732	.338	.559	.662	.495	.625	.505
0.200	-0.0400	0.800	0.270	-0.0493	0.730	0.340	-0.0561	0.660	0.500	-0.0625	0.500
.202	.403	.798	.272	.495	.728	.342	.563	.658	.505	.625	.495
.204	.406	.796	.274	.497	.726	.344	.564	.656	.510	.625	.490
.206	.409	.794	.276	.500	.724	.346	.566	.654	.515	.624	.485
.208	.412	.792	.278	.502	.722	.348	.567	.652	.520	.624	.480
0.210	-0.0415	0.790	0.280	-0.0504	0.720	0.350	-0.0569	0.650	0.525	-0.0623	0.475

TABLE XVII. FOURTH-DIFFERENCE CORRECTION $B_4(\delta_0^4 + \delta_1^4)$ Interpolating factor p : correction has same sign as difference $(\delta_0^4 + \delta_1^4)$

$\delta_0^4 + \delta_1^4$	0.00	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.25	0.30	0.35	0.40	0.50
50	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6
100	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.9	1.0	1.1	1.1	1.2
150	0.0	0.1	0.2	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.6	1.7	1.8
200	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.4	1.7	1.9	2.1	2.2	2.3
250	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.3	1.5	1.7	1.8	2.1	2.4	2.6	2.8	2.9
300	0.0	0.2	0.5	0.7	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.6	2.9	3.2	3.4	3.5
350	0.0	0.3	0.6	0.8	1.1	1.4	1.6	1.9	2.1	2.3	2.5	3.0	3.4	3.7	3.9	4.1
400	0.0	0.3	0.6	1.0	1.3	1.6	1.8	2.1	2.4	2.6	2.9	3.4	3.9	4.2	4.5	4.7
450	0.0	0.4	0.7	1.1	1.4	1.8	2.1	2.4	2.7	3.0	3.2	3.8	4.4	4.8	5.0	5.3
500	0.0	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.0	3.3	3.6	4.3	4.8	5.3	5.6	5.9
1.00	0.98	0.96	0.94	0.92	0.90	0.88	0.86	0.84	0.82	0.80	0.75	0.70	0.65	0.60	0.50	

Interpolating factor p : correction has same sign as difference $(\delta_0^4 + \delta_1^4)$

$$f_p = f_0 + p\delta_{13} + B_2(\delta_0^2 + \delta_1^2) + B_3\delta_{14}^3 + B_4(\delta_0^4 + \delta_1^4)$$

EXPLANATION

This explanation is limited to stating the precise meanings of the tabular quantities, and specifying the sources of the fundamental tables and constants used in calculating them. Complete explanations of the ephemerides and their computation are contained in a separate volume, *Explanatory Supplement to The Astronomical Ephemeris and The American Ephemeris and Nautical Almanac*, published by H. M. Stationery Office, London; it includes the formulae and the auxiliary tables with which the computations are made, and numerical examples of all the calculations.

Beginning with the volume for 1960, the tabular argument in the fundamental ephemerides of the Sun, Moon, and planets is Ephemeris Time; in nearly all of the other ephemerides, the argument is Universal Time. Ephemeris Time is the uniform measure of time defined by the laws of dynamics and determined in principle from the orbital motions of the planets, specifically the *orbital motion of the Earth* as represented by NEWCOMB's *Tables of the Sun*. Universal Time is defined by the *rotational motion of the Earth*, and is determined from the apparent diurnal motions which reflect this rotation; because of variations in the rate of the rotation, Universal Time is not rigorously uniform.

Ephemeris Time is the independent variable in the gravitational theories of the Sun, Moon, and planets. The Ephemeris Time at any instant is obtained from observation by directly comparing observed positions of the Sun, Moon, and planets with gravitational ephemerides of their coordinates; observations of the Moon are the most effective and expeditious for this purpose. An accurate determination, however, requires observations over a more or less extended period; in practice, it takes the form of determining the correction ΔT that must be applied to Universal Time to obtain Ephemeris Time:

$$\text{E.T.} = \text{U.T.} + \Delta T.$$

The Universal Time at any instant may be obtained with little delay from observations of the diurnal motions; it is the basis of civil timekeeping, and is the standard in astronomical observation and in the applications of astronomy to navigation and surveying. Ephemeris Time is the standard for purposes that require a strictly uniform measure. In order to provide a *relatively* uniform measure without delay, determinations of Universal Time, beginning with 1956, have been corrected for the variation of the meridian due to the observed motion of the geographic poles, and for the extrapolated annual variation in the rate of rotation of the Earth; the corrected value is distinguished by the notation UT2.

The numerical measure in which Ephemeris Time is reckoned is defined by the apparent *annual motion of the Sun in longitude*. Universal Time, in

principle, is determined by the *average* rate of the apparent *diurnal motion of the Sun relative to the meridian of Greenwich*; but in practice, the numerical measure of Universal Time at any instant is computed from a conventional relation to the measure of time defined by the diurnal motion of the equinox or First Point of Aries, known as *sidereal time*. The sidereal time at any instant may be rapidly and accurately determined from observations of the diurnal motions of stars.

The sidereal time is numerically measured by the hour angle of the equinox, which represents the position of the equinox in its diurnal circuit. The period of one diurnal circuit of the equinox in hour angle, between two consecutive upper meridian transits, is a sidereal day; it is divided into 24 sidereal hours, reckoned from 0^h at upper transit which is known as sidereal noon. The *true* equinox is at the intersection of the true equator of date with the ecliptic of date; the time measured by its diurnal motion is *apparent sidereal time*. The position of the true equinox is affected by the nutation of the axis of rotation of the Earth; and the nutation consequently introduces irregular periodic inequalities into the apparent sidereal time and the length of the sidereal day. The time measured by the diurnal motion of the *mean* equinox of date, which is affected only by the secular inequalities due to the precession of the axis, is *mean sidereal time*. Apparent sidereal time minus mean sidereal time is the *equation of the equinoxes* due to the nutation; in the volumes immediately preceding 1960, it was designated as the nutation in right ascension, and was included in the ephemeris of the Sun.

Universal Time is a particular case of the measure known in general as *mean solar time*. This measure is defined in principle by the apparent diurnal motion of a conventional fiducial point located on the mean celestial equator of date, and characterized by a uniform sidereal motion along the equator at a rate which only differs from the mean rate of the annual motion of the Sun along the ecliptic by the amount of the slight secular acceleration of the Sun. Relative to any meridian of longitude, this point has a diurnal motion in hour angle virtually the same as the average diurnal motion of the Sun, and with only very slight inequalities due to variations of the local meridian and variations of the rate of rotation of the Earth. The measure known as local mean solar time is derived from this fiducial point; but since the abstract point is not actually observable, the definition is formulated as a relation to sidereal time, and in practice mean solar time is obtained through this intermediary. Universal Time is the mean solar time on the Greenwich meridian, reckoned in days of 24 mean solar hours beginning with 0^h at midnight.

The relation that defines the numerical measure of mean solar time is derived from the position adopted for the fiducial point relative to the equinox, which is represented by a conventional formula for its right ascension. The practice in the past has been to adopt for the right ascension an expression as nearly identical with the expression for the mean longitude of the Sun on the ecliptic as is possible, consistent with a sidereal motion at a constant rate. Due to the secular acceleration of the Sun and to the different secular accelerations of the equinox on the ecliptic and the equator, the position in right ascension

differs from the mean longitude of the Sun in Newcomb's *Tables* by only a slight progressively increasing excess of $0^{\circ}0203 T^2$, where T is the number of centuries after 1900. The position in hour angle is never more than about 16^m from the Sun. This point, abstractly defined by the conventional expression for its right ascension, has therefore traditionally been called the fictitious mean sun. Its right ascension fixes its position among the stars at every instant, and is a means of exactly defining a measure of mean solar time by a relation to the sidereal time obtained from the observable diurnal motions of the stars.

This relation that defines mean solar time is expressed as a numerical formula for the sidereal time on the Greenwich meridian at the instant of mean midnight; the sidereal time calculated from this formula is the Greenwich hour angle of the equinox that *defines* 0^h U.T. and enables this instant to be identified by observation. The formula that is in established use was derived by adding 12^h to NEWCOMB'S expression for the right ascension of the fictitious mean sun; the mean sidereal time at 0^h U.T. of any calendar date is the numerical value of the resultant quantity

$$6^h 38^m 45^s.836 + 86\ 40184^s.542 T + 0^s.0929 T^2,$$

calculated with the value of T that denotes the number of Julian centuries of 36525 days which, at the midnight beginning the day, have elapsed since mean noon on 1900 January 0 at the Greenwich meridian. The instant at which the mean equinox reaches the Greenwich hour angle calculated from this formula is designated 0^h U.T. Each mean solar day is the period of time between the two instants at which the equinox reaches the hour angles calculated with the two values of the parameter T at an interval of $1/36525$ which denote consecutive dates.

Prior to the recognition of variations in the rotation of the Earth, mean midnight was considered to be the instant of lower meridian transit of the fictitious mean sun, since the formula is numerically the same as the expression for the right ascension of the fictitious mean sun increased by 12^h . However, as a consequence of the variations in rotation, the motion of the equinox in hour angle is slightly irregular; but meanwhile, the rate of motion of the fictitious mean sun relative to the equinox is completely independent of the variable rotation of the Earth, and consequently the actual right ascension plus 12^h does not reach the value calculated from a given value of T at exactly the *same instant* as does the hour angle of the equinox. The instant when the equinox reaches the calculated hour angle is midnight by definition; but the formula which represents the hour angle does not represent the right ascension of the mean sun plus 12^h for *this same instant*, and this additional designation previously often used for the sidereal time of 0^h has been eliminated from the ephemerides.

The sidereal and the mean solar measures are affected proportionally by the variations of the rotation; their ratio is a fixed constant, and the mean solar day is proportional to the period of rotation. The mean solar time at any instant on any meridian is determined from the observed local sidereal time at this instant by means of the constant ratio of the mean solar to the

sidereal measure, and the ephemeris of *Universal and Sidereal Times* on pages 10–17. The tabular sidereal times on successive dates are the Greenwich hour angles of the equinox that determine the instants of successive Greenwich mean midnights. At the instant of any observed Greenwich sidereal time, the interval which has elapsed since 0^h U.T., expressed in sidereal units, is immediately obtained by subtracting the tabular sidereal time at 0^h U.T. from the observed sidereal time at the instant. The Universal Time at the instant is the equivalent measure of this interval in units of mean solar time; it is obtained by multiplying the sidereal measure by the constant 0.99726 95664 which represents the ratio of the sidereal day to the mean solar day. The definition and practical determination of Universal Time were not affected by the introduction of Ephemeris Time in 1960, and the numerical reckoning was continued without discontinuity except for increased precision due to improved values of the nutation.

The ratio of the mean solar day to the mean sidereal day is 1.00273 79093, and the equivalent measures of the length of the day are:

Mean sidereal day . . . 23^h 56^m 04^s.09054 of mean solar time

Mean solar day 24^h 03^m 56^s.55536 of mean sidereal time

From these equivalents, Tables VIII and IX have been constructed for converting intervals of time from one measure to the other. To the order of accuracy of 0^s.01, these tables may be used for either mean or apparent sidereal time; but in more precise calculations, separate account must be taken of the equation of the equinoxes.

Calendar (Pages 1–3)

Over extended intervals, civil time is ordinarily reckoned according to conventional calendar years and adopted historical eras; in constructing and regulating civil calendars, and fixing ecclesiastical calendars, a number of auxiliary cycles and periods are used. The principal chronological eras and cycles are listed on page 1; and the Gregorian calendar for the current year is given on pages 2–3.

In astronomical practice prior to 1925, mean solar time was reckoned from noon instead of from midnight. The mean solar day beginning at noon, 12 hours *after* the midnight at the beginning of the same civil date, is known as the astronomical day. To facilitate chronological reckoning, the astronomical days beginning at Greenwich noon are numbered consecutively, from an epoch sufficiently far in the past to precede the historical period; the number which denotes a day in this continuous count is the Julian Day Number. The Julian Day reckoning begins with Julian Day Number 0 for January 1, 4713 B.C., Julian proleptic calendar; the Julian Day Number therefore denotes the length of time that has elapsed, at Greenwich noon at the beginning of the astronomical day, since this epoch. The Julian Day Numbers for the current year are given in the calendar; from Table I they may be found for other years up to A.D. 2300, and it is readily apparent how this table may be extended over any interval.

Dates expressed in Julian Days and fractions of a day represent time elapsed at the instant. In several of the ephemerides in this volume, the arguments are designated by the Julian Dates in addition to the Gregorian calendar dates. On pages where the argument is Ephemeris Time, the Julian Date, like the calendar date, refers to ephemeris days; but the Julian Day begins at 12^h E.T., the calendar day at 0^h E.T. The terminology *Julian Ephemeris Date* may be used to distinguish the Julian Date with the day beginning at 12^h E.T. instead of at 12^h U.T. (Greenwich Mean Noon), when it is essential to avoid ambiguity, as in dating orbital elements, or in formulae for light curves of variable stars, where the time must be given to a large number of decimals of a day.

The period of one complete circuit of the fictitious mean sun in right ascension, beginning at the instant when the right ascension is 18^h 40^m, is known as the Besselian solar year, and is an advantageous unit of time for some astronomical purposes. In 1967, the beginning of the Besselian year is January 1^d 041 Ephemeris Time; this instant is denoted by the notation 1967.0, and is given at the foot of each page of the calendar. Because of the secular excess of the right ascension of the fictitious mean sun over the mean longitude of the Sun, the Besselian year is shorter than the tropical year by the amount 0^s.148 *T*, where *T* denotes the time in centuries after 1900.

Phenomena (Pages 4–9)

The principal configurations of the Sun, Moon, and planets with one another during the year, and other phenomena of general interest, are listed on these pages.

The *Diary* on pages 5–7 contains, in chronological order with times to the nearest hour: the geocentric phenomena also given on page 4; occultations of the four bright stars *Aldebaran*, *Regulus*, *Spica*, and *Antares*, and of planets, for which, if any occur, another table is given on page 5 that includes the area of visibility, the tabular times being for geocentric conjunction in right ascension; and the dates of the eclipses and transits that occur during the year, for which the areas of visibility are indicated at the bottom of page 4. In addition, the *Diary* includes the phases of the Moon, and apogee and perigee of the Moon; the closest approach of Mars to the Earth, when the geocentric distance passes through a minimum; geocentric conjunctions in apparent right ascension of the planets with the Moon, with one another, and with the bright stars *Aldebaran*, *Pollux*, *Regulus*, *Spica*, and *Antares*, except when these phenomena occur within 24 hours of New Moon or within 10° of the Sun; and the geocentric phenomena of Ceres, Pallas, Juno, and Vesta, for which the dates alone are given at the bottom of page 8. The magnitudes and elongations from the Sun on every fifth day for the inferior planets and every tenth day for the superior planets, and approximate visual magnitudes of the minor planets Ceres, Pallas, Juno, and Vesta at 40-day intervals, are tabulated on pages 8–9. Revised values for the magnitudes of the minor planets were adopted, beginning with 1962.

The geocentric phenomena differ from the actually observed configurations by the effects of the geocentric parallax at the place of observation, which for configurations with the Moon may be quite large. The tabular times for the stationary points of the planets are the instants at which the planet is stationary in *apparent* geocentric right ascension; but for the elongations of the planets from the Sun, the tabular times are for the *geometric* configurations. The times of conjunction and opposition are, respectively, the instants when the apparent geocentric longitude of the planet differs by 0° and 180° from the geocentric longitude of the Sun. From inferior conjunction to superior conjunction of Mercury or Venus, or from conjunction to opposition of a superior planet, the elongation from the Sun is west; from superior to inferior conjunction, or from opposition to conjunction, the elongation is east. Because of the difference in latitude, the elongations do not in general pass through 0° or 180° as they change from west to east or from east to west. The tabular times of the greatest elongations of Mercury and Venus are the instants when the true geocentric angular distance from the Sun is a maximum.

The times of the equinoxes and solstices, which on page 4 are given to the nearest minute of Universal Time, are the instants when the apparent longitude of the Sun is a multiple of 90° .

The times given for the greatest brilliancy of Venus are the instants at which the value of the expression

$$\frac{(r + \Delta - R)(r + \Delta + R)}{r^3 \Delta^3}$$

is a maximum, where r and R denote, respectively, the heliocentric distances of Venus and the Earth, and Δ is the geocentric distance of Venus.

The heliocentric phenomena for which dates are given on page 4 are the perihelion and aphelion, the passages through the nodes on the ecliptic, and the greatest north and south heliocentric latitudes, in the actual disturbed motion. Because of perturbations, the dates are not in general the same as the dates that would be obtained from the elements of the mean orbit; the date on which the radius vector is a minimum may differ considerably from the date on which the heliocentric longitude of the planet is equal to the longitude of the perihelion of the mean orbit, and similarly the heliocentric longitude of the planet when its heliocentric latitude becomes zero may differ from the longitude of the mean node. At the ascending node, the planet passes through the plane of the ecliptic from south to north, and the heliocentric latitude vanishes in changing from negative to positive; at the descending node, the latitude changes from positive to negative as the planet passes through the plane of the ecliptic from north to south.

Universal and Sidereal Times (Pages 10–17)

The sidereal time (Hour Angle of First Point of Aries) at 0^h Universal Time, and the Universal Time at 0^h sidereal time (Transit of First Point of Aries), are tabulated both for the mean equinox of date, and for the true equinox

with the short-period terms of nutation included. In the ephemeris of sidereal time at 0^h U.T., the argument is the calendar date and the equivalent Julian Date. In the ephemeris of Universal Time at 0^h sidereal time on each day, the argument is the Greenwich Sidereal Date, defined as the number of sidereal days, determined by the equinox of date, that have elapsed at Greenwich since the beginning of the sidereal day which was in progress at J.D. 0.0. The integral part of the Greenwich Sidereal Date is called the Greenwich Sidereal Day Number; it is a means of consecutively numbering the successive sidereal days beginning at the *transits* of the First Point of Aries, similar to the Julian Day reckoning of the successive mean solar days beginning at the instants of the *tabular hour angles* of the First Point of Aries. The Greenwich Sidereal Day is the number of sidereal days that have elapsed at 0^h Greenwich sidereal time since the Greenwich sidereal 0^h that immediately preceded J.D. 0.0; the zero day is the sidereal day that was in progress at the beginning of the Julian Era.

From these ephemerides for the meridian of Greenwich, the local mean time on any meridian of longitude may be calculated from the local sidereal time, or conversely. For this purpose, the longitude is expressed in time. The measure of longitude in arc may be converted to the equivalent measure in time by Table XII; the reverse transformation is obtained by Table XI.

The longitude expressed in time and reckoned positive westward is numerically the amount by which Universal Time is greater than the local mean solar time at the same instant. At the instant when the local mean time is 0^h, the longitude is therefore the measure of the interval of mean solar time that has elapsed at Greenwich since 0^h U.T.; and adding the equivalent measure of this mean solar interval in units of sidereal time to the Greenwich sidereal time at 0^h U.T. gives the sidereal time at Greenwich at the instant when the mean solar time on the *local* meridian is 0^h. Like the mean solar times, the Greenwich sidereal time is greater than the local sidereal time at the *same* instant by the amount of the longitude; and therefore the *local* sidereal time at 0^h local mean solar time is obtained directly by adding to the tabular Greenwich sidereal time at the *previous* instant of 0^h U.T. the same *correction* as required to convert the mean solar interval measured by the longitude into an equivalent sidereal interval. This reduction may either be taken from Table IX, or obtained by means of the hourly variation +9^s8565.

Similarly, the Universal Time of Greenwich sidereal 0^h may be reduced to the local mean solar time of 0^h local sidereal time at any longitude by applying the correction from Table VIII, or by means of the hourly variation -9^s8296.

Conversion of sidereal time to mean solar time

On 1967 July 7, at approximately 4^h local mean solar time, in longitude 85° 15' west (+ 5^h 41^m), the observed apparent sidereal time is 23^h 02^m 11^s.724. The Universal Time at this instant is approximately 10^h; the equation of the

equinoxes is therefore $-0^{\text{h}}53^{\text{m}}0$, and subtracting this amount from the observed sidereal time gives the local mean sidereal time.

Greenwich mean sidereal time, 0^{h} U.T., July 7	^h 18 ^m 57 ^s 06.235
Reduction for longitude (Table IX).	+ 56.018
Mean sidereal time, 0^{h} local mean solar time.	18 58 02.253
Local mean sidereal time at observation.	23 02 12.254
Sidereal interval since 0^{h} local mean solar time.	4 04 10.001
Reduction to mean solar interval (Table VIII).	- 40.001
Local mean solar time.	4 03 30.000

If the sidereal interval is less than $3^{\text{m}} 56^{\text{s}}.5$, there are two mean solar times corresponding to the sidereal time, one a few minutes after the preceding 0^{h} , and the other a few minutes before the following 0^{h} , at a mean solar time interval of about $23^{\text{h}} 56^{\text{m}} 04^{\text{s}}$. The approximate mean solar time always determines which one is to be taken. Any local sidereal time within an interval of less than $3^{\text{m}} 56^{\text{s}}.5$ after 0^{h} local mean solar time will occur a second time on the same mean solar day; the subtraction of the local sidereal time of 0^{h} from either of these two sidereal times will give the same numerical result, but the actual interval for the second value is 24 sidereal hours greater.

The conversion of sidereal time to mean solar time may also be made by adding to the mean solar time of the *preceding* local sidereal 0^{h} the equivalent of the sidereal time in units of mean solar time.

Conversion of mean solar time to sidereal time

To convert mean solar time to mean sidereal time, add to the local mean sidereal time at 0^{h} the equivalent measure of the local mean solar time in sidereal units. To obtain the apparent sidereal time, add further the equation of the equinoxes, interpolated to the time. As an example, on 1967 July 7, in longitude $85^{\circ} 15'$ west ($+5^{\text{h}} 41^{\text{m}}$), at $4^{\text{h}} 03^{\text{m}} 30^{\text{s}}$ local mean solar time, to determine the local sidereal time:

Greenwich mean sidereal time, 0^{h} U.T., July 7	^h 18 ^m 57 ^s 06.235
Reduction for longitude (Table IX).	+ 56.018
Local mean solar time	4 03 30.000
Reduction of local mean time to sidereal interval	+ 40.001
Local mean sidereal time	23 02 12.254
Equation of the equinoxes, July 7 ^d 406 U.T.	- 0.530
Local apparent sidereal time.	23 02 11.724

Sun, Moon, and Planets

In the fundamental ephemerides, except where otherwise stated, the tabular positions are *apparent* positions, i.e., the positions in which the Sun, Moon,

and planets would actually be seen from the center of the Earth at the tabular times, displaced by planetary aberration and referred to the coordinate systems determined by the instantaneous equator, ecliptic, and equinox, with Ephemeris Time as the argument; the value used for the light-time at unit distance is 498^s.38, corresponding to the adopted constant of aberration. For comparison with photographic observations, *astrometric* positions are given for Pluto and the minor planets; for the latter they are included with the apparent positions. Ephemerides that are intended for theoretical purposes, where a fixed reference system is needed, are referred to the *fixed equinox* of a convenient epoch; and Tables III and IV are for facilitating reductions from one equinox to another.

The tabular quantities at instants other than the tabular times may be obtained by interpolation with the requisite order of differences. For this purpose, differences are included in many of the ephemerides; and Tables XIII–XVII may be used for interpolation.

The ephemerides are computed strictly from the tables to which references are made, and with the standard values that are stated for the fundamental constants. In accordance with resolutions of the International Astronomical Union, no corrections are applied to bring the tables into better accord with later observations, and no change has been made in the conventionally adopted value of any fundamental constant that was used in the volumes immediately preceding 1960. Tabular values, when taken from the same tables, are unaltered by the adoption of Ephemeris Time, but the tabular argument is correctly designated as Ephemeris Time instead of Universal Time.

Meridian transits, transit ephemerides and other phenomena that depend upon hour angles and geographic location, when calculated from the fundamental ephemerides by the same procedures as used prior to 1960, are referred, not to the Greenwich meridian and to Universal Time, but to a meridian 1.002738 ΔT east of the geographic meridian of Greenwich, and to Ephemeris Time. This slightly different meridian is known as the *ephemeris meridian*; to facilitate the calculation of phenomena that depend upon the rotation of the Earth, it is used as an auxiliary reference meridian. Hour angles and longitudes reckoned from the ephemeris meridian are distinguished by the terms *ephemeris hour angle* and *ephemeris longitude*. The ephemeris hour angle of the equinox is called *ephemeris sidereal time*.

The *ephemeris transit* is the Ephemeris Time at the instant of transit across the *ephemeris meridian*. Interpolation to any local meridian by using the ephemeris longitude as the interpolating factor gives the Ephemeris Time of local transit across this meridian; in forming first differences of the tabular ephemeris transits for this purpose, it must not be overlooked that the *day* is part of each tabular time. At ephemeris transit, the ephemeris sidereal time is equal to the right ascension.

When referred to the ephemeris meridian, phenomena depending on the rotation of the Earth may be calculated in terms of Ephemeris Time by methods which formally are exactly the same as the procedures for calculations referred

to the Greenwich meridian in terms of Universal Time. The practical calculations are based on the principle that the tabular Greenwich sidereal time of 0^h U.T. is numerically equal to the ephemeris sidereal time of 0^h E.T.; that is, the equinox at 0^h E.T. is at the same hour angle from the ephemeris meridian as it is from the Greenwich meridian at 0^h U.T.

Until ΔT is known, local hour angles referred to a specific meridian of *geographic* longitude cannot be calculated; but the ephemeris longitude where the actual local hour angle has any particular value may be determined entirely in terms of Ephemeris Time, and this procedure is followed in predictions of the general circumstances of eclipses. As soon as ΔT becomes known, the longitudes may be referred to the Greenwich meridian, and the Universal Times when the hour angle has the given values at these geographic longitudes may be determined.

For the computation of ephemerides with Universal Time as the argument, the value of ΔT is specifically required. Since ΔT depends primarily upon the *irregular* variations in the rate of rotation of the Earth, it cannot be determined in advance with certainty and exactness, or incorporated in the tables, but must be separately applied as determined from time to time by actual observation. Since ephemerides must be computed several years in advance, those that have the argument Universal Time are necessarily based upon an extrapolated value of ΔT . However, the uncertainty of the extrapolation, over the relatively short intervals necessary, is within the order of accuracy to which these ephemerides are calculated; in practice, to the degree of precision needed, the ephemerides are for the most part unchanged by a transformation of the argument from Ephemeris Time to Universal Time.

Values of ΔT as determined from discussions of observations are tabulated on page vii, together with estimated values for several later years.

The method of converting an ephemeris from Ephemeris Time to Universal Time depends upon whether hour angles are involved in the computation of the tabular quantities. When the tabular values are independent of the rotation of the Earth, an ephemeris for 0^h Ephemeris Time may be converted to an ephemeris for 0^h Universal Time by interpolating the tabular values to an interval ΔT after 0^h Ephemeris Time; if second differences are negligible, the interpolated values are obtained by adding algebraically to each of the tabular values for 0^h Ephemeris Time the correction $\frac{\Delta T}{h} \delta_{\frac{1}{2}}$, where h is the tabular interval and $\delta_{\frac{1}{2}}$ denotes the first difference.

The Universal Time of transit of the Sun, Moon, or a planet across the meridian of Greenwich may be found by subtracting ΔT from the Ephemeris Time of Greenwich transit that is obtained by interpolating the ephemeris transit from the geographic longitude of the ephemeris meridian, 1.002738 ΔT east, to longitude 0°. The ephemeris transit is the time on the Greenwich meridian at the instant of transit across the ephemeris meridian; the Greenwich transit follows ephemeris transit at an interval which to a first approximation exceeds

ΔT by the time equivalent of the motion in right ascension during the interval ΔT . The Universal Time of Greenwich transit is, therefore, algebraically greater than the tabular ephemeris transit by approximately the amount $\frac{\Delta T}{h} \delta_{1/2}\alpha$.

Fundamental Units and Astronomical Constants

Time, Mass, and Length

The fundamental epoch from which Ephemeris Time is reckoned is the epoch that NEWCOMB designated as 1900 January 0, Greenwich Mean Noon, but which actually is 1900 January 0^d 12^h E.T.; the instant to which this designation is assigned is the instant near the beginning of the calendar year A. D. 1900 when the geometric mean longitude of the Sun referred to the mean equinox of date was 279°41'48".04 (*Trans. Int. Astr. Union*, vol. X, 1960, pages 72, 500). Ephemeris Time is the measure of time in which NEWCOMB's *Tables of the Sun* agree with observation.

The primary unit of Ephemeris Time is the tropical year, defined by the mean motion of the Sun in longitude at the epoch 1900 January 0^d 12^h E.T.; its length in ephemeris days is determined by the coefficient of T in NEWCOMB's expression for the geometric mean longitude of the Sun, L , referred to the mean equinox of date, given among the elements of the Sun. The *ephemeris second* is defined as 1/31556925.9747 of the tropical year for 1900 January 0^d 12^h E.T.; it has been formally adopted as the fundamental invariable unit of time by the Comité International des Poids et Mesures (*Procès-Verbaux des Séances*, deuxième sér. xxv, 77, 1957). The ephemeris day is 86400 ephemeris seconds. The former fundamental unit of time was the mean solar second, defined as 1/86400 of the mean solar day.

In the astronomical system of measures, the usual unit of time is the ephemeris day. The fundamental unit of mass is the mass of the Sun. The unit of length is the astronomical unit, defined as the unit of distance in terms of which, in KEPLER's Third Law $n^2a^3 = k^2(1+m)$, the semimajor axis a of an elliptic orbit must be expressed in order that the numerical value of the Gaussian constant k may be exactly 0.01720209895 when the unit of time is the ephemeris day (*Trans. Int. Astr. Union*, vol. VI, 1939, pages 20, 336, 357); in astronomical units, the mean distance of the Earth from the Sun, calculated by KEPLER's Law from the observed mean motion n and adopted mass m , is 1.0000 0003 (NEWCOMB).

Constants

Gaussian Constant of Gravitation $k = 0.01720\ 20989\ 50000$

$= 3548''18760\ 69651$ (Int. Astr. Union)

Solar Parallax 8"80

Constant of Nutation 9.21

Constant of Aberration 20.47

} Paris Conference, 1896

Velocity of light 299 860 km/sec = 186 324 statute miles/sec

(NEWCOMB and MICHELSON, *Astr. Pap. Amer. Eph.*, II, 202, 1891)

Equation of light

From constant of aberration	498 ^s 38
From velocity of light and solar parallax	498 ^s 58

International Ellipsoid of Reference (Bull. Géodésique, 1925, page 555)

*Flattening	$f = 1/297 = 0.003\ 367\ 003\ 367\ 003\ 367$
*Equatorial Radius	$a = 6378\ 388\ \text{m}$
Polar Radius	$a(1-f) = 6356\ 911.946\ \text{m}$
Square of eccentricity	$e^2 = 0.006\ 722\ 670\ 022\ 333\ 322$
Reduction from geodetic latitude ϕ to geocentric latitude ϕ'	
	$\phi' - \phi = -11' 35''.6635 \sin 2\phi + 1''.1731 \sin 4\phi - 0''.0026 \sin 6\phi$
Radius vector	
	$\rho = a(0.998\ 320\ 047 + 0.001\ 683\ 494 \cos 2\phi - 0.000\ 003\ 549 \cos 4\phi + 0.000\ 000\ 008 \cos 6\phi)$
One degree of latitude (m)	
	$111\ 136.54 - 562.21 \cos 2\phi + 1.18 \cos 4\phi$ (ϕ = mid-latitude of arc)
One degree of longitude (m)	
	$111\ 417.66 \cos \phi - 93.90 \cos 3\phi + 0.12 \cos 5\phi$
*Normal Gravity (cm/sec ²)	
	$g = 978.0490 (1 + 0.0052\ 884 \sin^2 \phi - 0.0000\ 059 \sin^2 2\phi)$
Free-air gravity correction, cm/sec ² , at an elevation (in m) of H	
	$-(0.0003\ 0855 + 0.0000\ 0022 \cos 2\phi) H + 0.0000\ 72 (H/1000)^2$
Length of seconds pendulum (m)	
	$0.9935\ 882 - 0.0026\ 203 \cos 2\phi + 0.0000\ 029 \cos 4\phi$

*Adopted values, from which other quantities are derived.

Annual rates of precession (NEWCOMB, Astr. Pap. Amer. Eph., VIII, 73, 1897)

General precession	$p = 50''.2564 + 0''.0222\ T$
Planetary precession	$\lambda' = 0''.1247 - 0''.0188\ T$
Lunisolar precession	$\psi = 50''.3708 + 0''.0050\ T$
Precession in right ascension	$m = 3^s.07234 + 0^s.00186\ T$
Precession in declination	$n = 20''.0468 - 0''.0085\ T$

The time T is measured in tropical centuries from 1900.0. The values of p , m , and n at the beginning of the Besselian solar year are given on page 50.

These *rates* of the precessional motions at a particular epoch must be carefully distinguished from the accumulated *amounts* of the motions over an extended interval of time, and the consequent displacements of the coordinate systems which the precessional motions produce. The amount of the precession in right ascension during the interval of time from t_0 to t is $\zeta_0 + z$, where $90^\circ - \zeta_0$ is the right ascension of the ascending node of the mean equator at time t on the mean equator of t_0 reckoned from the mean equinox of t_0 , and $90^\circ + z$ is the right ascension of the node reckoned from the mean equinox of t ; the amount of the precession in declination is the inclination θ of the mean equator

at time t to the mean equator of t_0 . For $t_0 = 1950.0$, with the interval of time T from this epoch measured in tropical centuries,

$$\begin{aligned}\zeta_0 &= +2304''.948 \ T + 0''.302 \ T^2 + 0''.0179 \ T^3, \\ z &= +2304''.948 \ T + 1''.093 \ T^2 + 0''.0192 \ T^3, \\ \theta &= +2004''.255 \ T - 0''.426 \ T^2 - 0''.0416 \ T^3.\end{aligned}$$

Interchanging t_0 with t replaces ζ_0 by $-z$, and z by $-\zeta_0$, and changes the sign of θ .

On page 50, the numerical values are given for these precessional displacements of the mean equator and mean equinox during the interval between 1950.0 and the beginning of the current year; and Table III contains values for other intervals. Over a short interval, the values of $\zeta_0 + z$ and θ may be obtained from the rates m and n of the precessions at the *midpoint of the interval*, by the formulae

$$M = m(t_0 - t), \quad N = n(t_0 - t).$$

Similarly, the amounts of the general precession in longitude a , and rotation of the ecliptic b , may be calculated from the rate of precession p , and speed of rotation of the ecliptic π , at the midpoint of the interval, by

$$a = p(t_0 - t), \quad b = \pi(t_0 - t).$$

The numerical values of these quantities for the interval between 1950.0 and the current year, and of

$$c = 180^\circ - \Pi + \frac{1}{2}a$$

where Π is the longitude of the axis of rotation of the ecliptic at the midpoint of the interval, are also given on page 50, with formulae for calculating the corresponding precessional variations of equatorial and ecliptic coordinates, and of the ecliptic elements Ω , i , ω , of an orbit. Expressions for calculating π and Π at any date are given among the elements of the Sun.

Nutation

The formulae adopted for computing the nutation in longitude and obliquity are obtained by retaining all terms with coefficients as great as $0''.0002$ from the expressions developed in *Astr. Pap. Amer. Eph.*, vol. XV, Part I, page 153, 1953; they are given in *Astr. Jour.*, 58, 2, 1953, and in the *Explanatory Supplement*.

The effects of short-period terms, defined as terms with periods of less than 35 days, are fully included in the ephemerides of the Sun, Moon, and planets.

Sun (Pages 18–50)

The ephemerides of the Sun are derived from the geometric longitude referred to the mean equinox of date, the latitude referred to the ecliptic of date, the logarithm of the radius vector, and the mean obliquity of date, that

are taken from NEWCOMB'S *Tables of the Sun, Astr. Pap. Amer. Eph.*, vol. VI, Part I, 1895. The mean orbital elements on which these tables are based, with T denoting the time measured in Julian centuries of 36525 ephemeris days from the epoch, and d the time in ephemeris days, are:

$$\text{Epoch 1900 January 0.5 E.T.} = \text{J.D. 241 5020.0}$$

Geometric mean longitude, mean equinox of date

$$\begin{aligned} L &= 279^\circ 41' 48''.04 + 1296 \ 02768''.13 T + 1''.089 T^2 \\ &= 279^\circ.69668 + 0^\circ.98564 \ 73354 d + 0^\circ.000303 T^2 \end{aligned}$$

Mean longitude of perigee, mean equinox of date

$$\begin{aligned} \Gamma &= 281^\circ 13' 15''.0 + 6189''.03 T + 1''.63 T^2 + 0''.012 T^3 \\ &= 281^\circ.22083 + 0^\circ.00004 \ 70684 d + 0^\circ.000453 T^2 + 0^\circ.000003 T^3 \end{aligned}$$

Mean anomaly, $L - \Gamma$

$$\begin{aligned} g &= 358^\circ 28' 33''.0 + 1295 \ 96579''.10 T - 0''.54 T^2 - 0''.012 T^3 \\ &= 358^\circ.47583 + 0^\circ.98560 \ 02670 d - 0^\circ.000150 T^2 - 0^\circ.000003 T^3 \end{aligned}$$

Eccentricity

$$e = 0.01675 \ 104 - 0.00004 \ 180 T - 0.00000 \ 0126 T^2$$

The principal related auxiliary constants are:

Mean obliquity of the ecliptic

$$\begin{aligned} \epsilon &= 23^\circ 27' 08''.26 - 46''.845 T - 0''.0059 T^2 + 0''.00181 T^3 \\ &= 23^\circ.452294 - 0^\circ.01301 \ 25 T - 0^\circ.00000 \ 164 T^2 + 0^\circ.00000 \ 0503 T^3 \end{aligned}$$

Annual rate of rotation of ecliptic $\pi = 0''.4711 - 0''.0007 T$

Longitude of axis of rotation $\Pi = 173^\circ 57'.06 + 54'.77 T$

Lengths of the years

Tropical	$365^d \ 2421 \ 9879 - 0^d.0000 \ 0614 T$
	$365^d \ 05^h \ 48^m \ 46^s.0 - 0^s.530 T$
Sidereal	$365^d \ 2563 \ 6042 + 0^d.0000 \ 0011 T$
	$365^d \ 06^h \ 09^m \ 09^s.5 + 0^s.01 T$
Anomalistic	$365^d \ 2596 \ 4134 + 0^d.0000 \ 0304 T$
	$365^d \ 06^h \ 13^m \ 53^s.0 + 0^s.26 T$
Eclipse	$346^d \ 6200 \ 31 + 0^d.0000 \ 32 T$
	$346^d \ 14^h \ 52^m \ 50^s.7 + 2^s.8 T$

The longitude of the axis of rotation of the ecliptic is for the extremity that is at the ascending node of the instantaneous position of the ecliptic on the immediately preceding position; and it is referred to the mean equinox of date. The position of the ecliptic in terms of its inclination π_1 and node Π_1 on the fixed ecliptic of the epoch is represented by

$$\begin{aligned} \pi_1 \sin \Pi_1 &= +4''.964 T + 0''.1939 T^2 - 0''.00019 T^3, \\ \pi_1 \cos \Pi_1 &= -46''.845 T + 0''.0545 T^2 + 0''.00035 T^3. \end{aligned}$$

The values of L and g for every tenth day, the values of Γ and e at the beginning of the calendar year, and of π , Π , and ϵ and the trigonometric functions of ϵ for the beginning of the Besselian year, are given on page 50.

The geocentric spherical coordinates of the Sun are tabulated in the ephemeris on pages 18–33. The geocentric equatorial rectangular coordinates are given on pages 34–49, referred to the mean equator and equinox of both the beginning of the year and 1950.0; the dates in bold-face type are the standard 10-day ephemeris dates recommended by the International Astronomical Union, for which the integral part of the Julian Day Number is divisible by 10. The positive X -axis is directed toward the equinox, the Y -axis toward the point on the equator at right ascension 6^h , and the Z -axis toward the north pole of the equator.

The tabular longitude is the geometric longitude referred to the mean equinox of the beginning of the Besselian year; it may be reduced to the fixed mean equinox of 1950.0 by applying the correction given in the footnote. The values of the latitude referred both to the ecliptic of the beginning of the year and to the fixed ecliptic of 1950.0 are tabulated, in addition to the latitude referred to the ecliptic of date.

The precession in longitude is the amount of the precessional displacement of the equinox along the ecliptic since the beginning of the Besselian year. Adding it to the tabular longitude gives the geometric longitude referred to the mean equinox of date, which may be further reduced to the true equinox of date by adding the nutation in longitude. The nutation includes short-period terms.

The reduction to apparent longitude is the sum of the nutation in longitude at date and the precession from the beginning of the year to date, diminished by aberration which is calculated by dividing $20''.47$ by the radius vector.

The horizontal parallax is the angle subtended at the Sun by the equatorial radius of the Earth; the tabular values are calculated by dividing $8''.80$ by the radius vector.

The apparent right ascension and declination are referred to the true equinox and equator of date, and are affected by aberration. They are calculated from the geometric longitude, the latitude referred to the ecliptic of date, and the tabular obliquity of date, which is the sum of the mean obliquity and the nutation in obliquity inclusive of short-period terms; they are corrected for aberration by antedating for the light-time. The value of the radius vector is geometric, not affected by aberration.

The tabular semidiameter includes an allowance for irradiation, and is obtained by dividing an enhanced value of the semidiameter at unit distance by the radius vector, although actually the irradiation does not depend upon the distance; the value adopted for the enhanced semidiameter at unit distance is $16' 01''.18$.

Moon (Pages 51–159)

The lunar ephemeris is calculated directly from BROWN's theory instead of from his *Tables of the Motion of the Moon*; but in order to obtain a strictly gravitational ephemeris expressed in the same measure of time as defined by

NEWCOMB'S *Tables of the Sun*, the orbital elements upon which BROWN'S tables are based are amended by removing the empirical term and by applying to the mean longitude the correction

$$-8^{\circ}.72 - 26^{\circ}.74 T - 11^{\circ}.22 T^2,$$

where T is measured in Julian centuries from 1900 January 0.5 E.T. = J.D. 2415020.0.

Denoting by d the number of ephemeris days from the epoch, the fundamental orbital constants are

$$\begin{aligned}\mathcal{C} &= 270^{\circ} 26' 02^{\circ}.99 + 1336' 307^{\circ} 52' 59^{\circ}.31 T - 4^{\circ}.08 T^2 + 0^{\circ}.0068 T^3 \\ &= 270^{\circ}.434164 + 13^{\circ}.17639 65268 d - 0^{\circ}.001133 T^2 + 0^{\circ}.0000019 T^3,\end{aligned}$$

$$\begin{aligned}\Gamma' &= 334^{\circ} 19' 46^{\circ}.40 + 11' 109^{\circ} 02' 02^{\circ}.52 T - 37^{\circ}.17 T^2 - 0^{\circ}.045 T^3 \\ &= 334^{\circ}.329556 + 0^{\circ}.11140 40803 d - 0^{\circ}.010325 T^2 - 0^{\circ}.000012 T^3,\end{aligned}$$

$$\begin{aligned}\Omega &= 259^{\circ} 10' 59^{\circ}.79 - 5' 134^{\circ} 08' 31^{\circ}.23 T + 7^{\circ}.48 T^2 + 0^{\circ}.008 T^3 \\ &= 259^{\circ}.183275 - 0^{\circ}.05295 39222 d + 0^{\circ}.002078 T^2 + 0^{\circ}.000002 T^3,\end{aligned}$$

$$e = 0.05490 0489,$$

$$\gamma = 0.04488 6967,$$

$$\text{Constant of sine parallax, } 3422^{\circ}.5400,$$

where γ is the sine of half the inclination to the ecliptic, e denotes the eccentricity, and

\mathcal{C} , the mean longitude of the Moon, measured in the ecliptic from the mean equinox of date to the mean ascending node of the lunar orbit, and then along the orbit;

Γ' , the mean longitude of the lunar perigee, measured in the ecliptic from the mean equinox of date to the mean ascending node of the lunar orbit, and then along the orbit;

Ω , the longitude of the mean ascending node of the lunar orbit on the ecliptic, measured from the mean equinox of date.

The equatorial horizontal parallax at distance 60.2665 equatorial radii of the Earth is $57' 02^{\circ}.70$.

In the lunar theory, the adopted ratio of the mass of the Earth to the mass of the Moon is 81.53.

The mean elongation of the Moon from the Sun is

$$\begin{aligned}D &= 350^{\circ} 44' 14^{\circ}.95 + 1236' 307^{\circ} 06' 51^{\circ}.18 T - 5^{\circ}.17 T^2 + 0^{\circ}.0068 T^3 \\ &= 350^{\circ}.737486 + 12^{\circ}.19074 91914 d - 0^{\circ}.001436 T^2 + 0^{\circ}.0000019 T^3.\end{aligned}$$

The lengths of the months for the epoch 1900 are

	^d	^d	^h	^m	^s
Synodic	29.530 589	29	12	44	02.9
Tropical	27.321 582	27	07	43	04.7
Sidereal	27.321 661	27	07	43	11.5
Anomalistic	27.554 551	27	13	18	33.2
Draconitic	27.212 220	27	05	05	35.8

The secular variations do not exceed a few hundredths of a second per century, and depend partly upon the variations in the rate of rotation of the Earth.

The values of Γ' , Ω , ζ , and D for every tenth day are tabulated on page

51. This page also contains, for every tenth day, the values of

i , the inclination of the mean equator of the Moon to the true equator of the Earth,

Δ , the arc of the mean equator of the Moon from its ascending node on the true equator of the Earth to its ascending node on the ecliptic of date,

Ω' , the arc of the true equator of the Earth from the true equinox of date to the ascending node of the mean equator of the Moon,

calculated with HAYN'S value of $1^\circ 32' 1''$ for the inclination of the mean lunar equator to the ecliptic; the ascending node of the mean lunar equator on the ecliptic is at the descending node of the mean lunar orbit, $\Omega \pm 180^\circ$.

The longitude referred to the mean equinox of date, the latitude referred to the ecliptic of date, and the horizontal parallax (pages 52–67) are computed for every half-day from BROWN'S theoretical expressions, with the corrections required for the amendment to the mean longitude. The apparent longitude and latitude are obtained by adding the nutation in longitude and some residual effects of aberration not included in BROWN'S expressions. (*Astr. Jour.*, **57**, 46, 1952).

The semidiameter, s , is derived from the horizontal parallax, π , by the formula

$$s = 0''0796 + 0.272446 \pi,$$

the constants in which are based on NEWCOMB'S value of $15' 32'' 58$ for the semidiameter at mean distance (Researches on the Motion of the Moon, Part II, *Astr. Pap. Amer. Eph.*, vol. IX, 39, 1912). No correction is made for irradiation.

The apparent right ascension and declination for each hour of Ephemeris Time (pages 68–159) are calculated for 0^h and 12^h from the apparent longitude, the apparent latitude, and the true obliquity of date; and for the other hours by interpolation.

Page 159 contains the phases of the Moon, and the times of perigee and apogee or least and greatest distances from the Earth. The times of New Moon, First Quarter, Full Moon and Last Quarter are the times at which the excess of the apparent longitude of the Moon over the apparent longitude of the Sun is 0° , 90° , 180° , and 270° , respectively. The lunations are numbered in continuation of E. W. BROWN'S series, of which No. 1 commenced on 1923 January 16 (*Mon. Not. Roy. Astr. Soc.*, **93**, 603, 1933).

The Planets (Pages 160–257)

The orbital longitudes and the heliocentric ecliptic longitudes referred to the mean equinox of date, the heliocentric latitudes referred to the ecliptic

of date, and the radii vectores of the *inner planets* Mercury, Venus, and Mars are taken from NEWCOMB'S tables in *Astr. Pap. Amer. Eph.*, vol. VI, Parts II, III, IV, 1895-1898; for Mars, the corrections derived by Ross, *Astr. Pap. Amer. Eph.*, vol. IX, Part II, 1917, are applied. The orbital elements are for the mean orbits. For Venus and Mars, the latitude referred to the mean orbit, due to periodic perturbations in latitude, is included in the heliocentric ephemerides.

The ephemerides of the *outer planets* Jupiter, Saturn, Uranus, Neptune, and Pluto, are computed from the heliocentric rectangular coordinates obtained by numerical integration in *Astr. Pap. Amer. Eph.*, vol. XII, 1951. Perturbations by the inner planets, taken from *Astr. Pap. Amer. Eph.*, vol. XIII, Part V, 1954, are included in the geocentric ephemerides, but are omitted from the heliocentric ephemerides, and from the heliocentric orbital elements. The elements are for the osculating orbits.

In these ephemerides, the adopted masses of the planets and the formulae for the mean elements of the inner planets are given in the *Explanatory Supplement*.

The geocentric ephemerides are calculated from the heliocentric coordinates of the planets and the geocentric coordinates of the Sun. The *apparent* right ascension and declination are referred to the true equator and equinox of date, inclusive of the short-period terms of nutation; and they have been corrected for planetary aberration.

The *astrometric* positions of Pluto and the minor planets are obtained by adding the planetary aberration to the geometric ephemeris referred to a standard mean equinox such as that of 1950.0, and then subtracting stellar aberration, calculated by the conventional formula which neglects the part depending on the longitude of the perihelion of the Earth. The astrometric ephemeris is therefore rigorously comparable with observations that are referred to catalogue mean places of comparison stars (corrected for proper motion and annual parallax, if significant, to the epoch of observation), it being only necessary to correct the observations for geocentric parallax.

The tabular true distance from the Earth is the actual geocentric distance at the tabular time, *not* at the instant when the light that reaches the observer at the tabular time left the planet.

The horizontal parallax is $8''.80$ divided by the geocentric distance. The tabular semidiameter is the value at unit distance divided by the geocentric distance; the adopted semidiameters at unit distance are:

Mercury	3''34	Saturn:	
Venus	8''41	Equatorial	83''33
Mars.	4''68	Polar	74''57
Jupiter:		Uranus	34''28
Equatorial	98''47	Neptune	36''56
Polar.	91''91		

The authorities for these values are given in the *Explanatory Supplement*.

The ephemerides of the minor planets Ceres, Pallas, Juno, and Vesta are computed from heliocentric rectangular coordinates calculated by PAUL HERGET, *Astr. Pap. Amer. Eph.*, vol. XVI, Part III, 1962.

The ephemerides are in the same form as for Pluto, with the addition of the reductions from astrometric to apparent right ascension and declination. Daily positions are given for the periods during which the planet is more than about 40° from the Sun. Since accurate observations of the minor planets may lead to an improved value for the mass of the Moon, the dates on which the lunar inequality is a maximum in right ascension are indicated by an asterisk. The magnitudes are *photographic*; revised values were adopted, beginning with 1962.

Stars

The star places that are given in this volume are limited to the mean places of the brighter stars at the beginning of the Besselian year, to an accuracy of $0^s.1$ in right ascension and $1''$ in declination. However, the volume contains all the data necessary for the accurate reduction of precise star places from one epoch to another, or from mean place to apparent place. Examples of these reductions are given in the *Explanatory Supplement*.

Day Numbers (Pages 258–281)

The Besselian Day Numbers and the Independent Day Numbers are given for 0^h Ephemeris Time, with the sidereal time to the nearest tenth of an hour to assist in determining the interpolating factor for the time of meridian transit of a star. They are followed by the Besselian Day Numbers at 0^h Greenwich sidereal time; these are derived quantities, and the third decimal is uncertain by one unit.

From these Day Numbers, the reduction from mean place to apparent place for precession, nutation, and aberration is obtained to the first order. The additional Day Numbers necessary to determine the reduction to the second order, tabulated separately for northern and southern declinations, are given on pages 278–281.

To avoid a second-order reduction as far as possible, the Day Numbers are referred to the *nearest* beginning of a year, instead of always to the beginning of the current year. For any tabular date, τ denotes the fraction of a tropical year that has elapsed since the date to which the tabular values of the Day Numbers are referred; and the apparent place is obtained with these Day Numbers from the mean place at the beginning of either the *current* Besselian year or the *next following* year, according to the tabular value of τ . In consequence, all the Day Numbers except *B* and *E* are discontinuous at the middle of the year; for July 1 and 2, values are given for both epochs. By not extending the reduction over more than half a year,

the second-order reduction and the error from neglecting it are kept as small as practicable.

The reductions to the second order, including the proper motion, are

$$\begin{aligned}\alpha &= \alpha_0 + \tau\mu_\alpha + Aa + Bb + Cc + Dd + E + J \tan^2 \delta_0 \\ &= \alpha_0 + \tau\mu_\alpha + f + g \sin (G + \alpha_0) \tan \delta_0 + h \sin (H + \alpha_0) \sec \delta_0 + J \tan^2 \delta_0, \\ \delta &= \delta_0 + \tau\mu_\delta + Aa' + Bb' + Cc' + Dd' + J' \tan \delta_0 \\ &= \delta_0 + \tau\mu_\delta + g \cos (G + \alpha_0) + h \cos (H + \alpha_0) \sin \delta_0 + i \cos \delta_0 + J' \tan \delta_0,\end{aligned}$$

where zero subscripts denote the mean place, and

$$\begin{aligned}a &= \frac{m}{n} + \sin \alpha_0 \tan \delta_0, & a' &= \cos \alpha_0, \\ b &= \cos \alpha_0 \tan \delta_0, & b' &= -\sin \alpha_0, \\ c &= \cos \alpha_0 \sec \delta_0, & c' &= \tan \epsilon \cos \delta_0 - \sin \alpha_0 \sin \delta_0, \\ d &= \sin \alpha_0 \sec \delta_0, & d' &= \cos \alpha_0 \sin \delta_0,\end{aligned}$$

which are known as the Besselian Star Constants. Additional corrections for parallax may be obtained from

$$\begin{aligned}\Delta\alpha &= \pi (cY - dX), \\ \Delta\delta &= \pi (c'Y - d'X),\end{aligned}$$

where X, Y are the coordinates of the Sun and c, d, c', d' are the Besselian Star Constants. In the case of binary stars, a correction for orbital motion may be necessary. The tabular values of the Day Numbers A, B, C, D, g, h, i , are in seconds of arc; when used for reducing right ascension, either they or the Star Constants by which they are multiplied must be divided by 15 to express the reduction in seconds of time.

The Besselian Day Numbers A, B , and E , or the Independent Day Numbers f, g , and G , give the reduction for precession and nutation. The short-period terms of nutation in longitude and obliquity, $d\psi$ and $d\epsilon$, respectively, and the Day Numbers f', g', G' , for obtaining the effects of these terms alone, are also tabulated. The Day Numbers f', g', G' are defined as:

$$\begin{aligned}f' &= +d\psi \cos \epsilon \\ g' \sin G' &= -d\epsilon \\ g' \cos G' &= +d\psi \sin \epsilon\end{aligned}$$

The Day Numbers C and D , or H, h , and i , give the reduction for aberration; they are derived from the actual disturbed velocity of the Earth referred to the center of mass of the solar system.

The Besselian Day Numbers are the most expeditious means of reduction when several apparent positions of the same star are required, or when the values of the Besselian Star Constants are already available; otherwise, the Independent Day Numbers are the more convenient.

Reductions for precession and nutation directly from the standard equinox of 1950.0 to the true equinox of date may be obtained with sufficient accuracy for a finding ephemeris of a comet or a minor planet by means of Table IV, in accordance with the formulae at the foot of the table. The tabular dates are the midnights following an integral Julian Date that is exactly divis-

ible by 10, in accordance with the resolutions of the International Astronomical Union that the osculation epochs of elements of comets and minor planets should be Julian Dates with the integral part divisible by 400, and that ephemerides should be for 10-day intervals. Dates followed by an asterisk are the Julian Dates with integral part divisible by 40.

To facilitate the reduction of observations in which the differences of right ascension and declination between two celestial objects are measured, the differential aberration and the differential precession and nutation may be determined from Tables V and VI in accordance with the precepts given with the tables. With the position of a star reduced to the equinox of 1950.0, or to the equinox of the nearest beginning of a year, the coordinates of an object referred to the same equinox are obtained by adding to the coordinates of the star the observed differences in the sense "object minus star", and the differential aberration, precession, and nutation taken from these tables.

Mean Places of Stars (Pages 282-292)

Mean places at the beginning of the Besselian year are tabulated for 1078 stars, including stars to a limiting magnitude 4.75 excepting 8 stars each within 30" of an included star; variable stars are in general included if the maximum is brighter than magnitude 4.7. The positions are taken from the Albany *General Catalogue of 33342 Stars for the Epoch 1950, 1937*. Beginning with 1965, the stars are tabulated in the order of their mean right ascensions at the epoch 1970.0. In the name of the star, the three-letter abbreviations for constellation names recommended by the International Astronomical Union are used; a list of these abbreviations is given in the *Explanatory Supplement*.

Disregarding proper motion, which is generally much less than a second of arc per year, the mean places at other epochs may be obtained by a reduction for precession alone. In particular, to obtain the mean place at the beginning of the next following year, which is required for calculating reductions from mean to apparent places with the tabular Day Numbers during the latter half of the current year, add to the tabular coordinates the reductions

$$\begin{aligned}\Delta\alpha &= m + n \sin \alpha \tan \delta, \\ \Delta\delta &= n \cos \alpha,\end{aligned}$$

where the values of m and n are taken from page 50. Formulae and constants for the reduction of right ascension and declination, and of longitude and latitude, for precession from the beginning of the current year to 1950.0 and in the reverse direction, are also given on page 50; and an extended tabulation of the equatorial precessional constants for other intervals is given in Table III.

Table III contains the reduction constants ζ_0 , z , and θ for rigorous trigonometric reductions of mean places to the beginning of the current year from the beginning of each fifth previous year back to 1755; and also the coefficients M and N for approximate reductions with the formulae on page 50. The table is calculated from formulae derived from NEWCOMB'S numerical expressions for the precessional displacements of the mean equator, *Astr. Pap. Amer. Eph.*,

vol. VIII, page 75, 1897; M and N are obtained from the rates of change of $z + \zeta_0$ and θ at the time midway from t_0 to t . With the tabular constants, rigorous reductions of the coordinates α_0, δ_0 , referred to the mean equinox of t_0 , to the coordinates α, δ , referred to the mean equinox of the beginning of the current year, may be calculated from the formulæ

$$\begin{aligned} g &= \sin \theta [\tan \delta_0 + \cos (\alpha_0 + \zeta_0) \tan \tfrac{1}{2} \theta], \\ \tan (\Delta\alpha - \mu) &= \frac{g \sin (\alpha_0 + \zeta_0)}{1 - g \cos (\alpha_0 + \zeta_0)}, \\ \mu &= \zeta_0 + z, \\ \alpha &= \alpha_0 + \Delta\alpha, \\ \tan \tfrac{1}{2} (\delta - \delta_0) &= \tan \tfrac{1}{2} \theta \sec \tfrac{1}{2} (\Delta\alpha - \mu) \cos [(\alpha_0 + \zeta_0) + \tfrac{1}{2} (\Delta\alpha - \mu)]. \end{aligned}$$

Eclipses (Pages 293–299)

Elements and general circumstances are given for all solar and lunar eclipses, including penumbral lunar eclipses, which occur during the year. For solar eclipses, maps are given from which approximate local circumstances may be obtained for any particular place; and the Besselian elements are tabulated at 10-minute intervals for the calculation of accurate predictions for any point on or above the surface of the Earth. For total or annular eclipses the latitudes and longitudes of points on the central line and on the northern and southern limits, together with the duration of the total or annular phase and the altitude of the Sun on the central line, are tabulated at intervals of five minutes or less throughout the eclipse. For lunar eclipses, the circumstances and their Ephemeris Times or Universal Times are the same for all parts of the Earth; any particular phase is visible from the hemisphere over which the Moon is then above the horizon.

The elements and circumstances are computed in accordance with BESSEL's method, for the International Ellipsoid, from apparent right ascensions and declinations of the Sun and Moon which include the short-period terms of nutation; and the coordinates of the Sun for this purpose are calculated to an additional decimal. The semidiameters of the Sun and Moon used in the calculation of eclipses do not include irradiation. The adopted semidiameter of the Sun at unit distance is $15' 59''.63$ (AUWERS, *Astronomische Nachrichten*, 3068, 367, 1891), the same, except for irradiation, as in the ephemeris of the Sun. In calculating the duration of *total* solar eclipses on the central line, the apparent semidiameter of the Moon is obtained by putting its sine equal to $0.272274 \sin \pi$, where π is the horizontal parallax; but beginning with 1963, the adopted semidiameter of the Moon in *all other eclipse calculations* is $0.272446 \pi + 0''.079$. To obtain the tabular duration of the total phase, the correction $+0.000\ 207$ must be applied to the tabular radius of the umbra.

In the calculation of lunar eclipses, the radius of the geometric shadow of the Earth is increased by one-fiftieth part to allow for the effect of the atmos-

phere. Otherwise, refraction is neglected in computing solar and lunar eclipses. The Besselian elements do not involve refraction. The circumstances of eclipses are calculated for the surface of the ellipsoid, and the inclusion of refraction in them would be inappropriate. For local predictions, corrections for refraction are unnecessary; they are required only in precise comparisons of theory with observation, in which many other refinements are also necessary.

The magnitude of a solar eclipse is the fraction of the solar diameter obscured by the Moon at greatest phase, measured along the common diameter. The magnitude of a lunar eclipse is the fraction of the lunar diameter obscured by the shadow of the Earth at greatest phase, measured along the common diameter.

On the solar eclipse maps, the curves drawn in long dashes indicate the times halfway between first and last contacts of the penumbra. These times of the middle of the eclipse should not be confused with the times of greatest eclipse, from which they may differ by several minutes. The curves drawn in short dashes give the semiduration of the partial phase. The Ephemeris Times of first and last contacts are derived from the time of middle by respectively subtracting and adding the semiduration. The curves are extended across the rising and setting limits of the eclipse, although part of the phenomenon occurs below the horizon for observers in those regions.

The Besselian elements characterize the geometric position of the shadow of the Moon relative to the Earth. The exterior tangents to the surfaces of the Sun and the Moon form the umbral cone, the interior tangents the penumbral cone. The common axis of the two cones is the axis of the shadow. The geocentric plane perpendicular to the axis of the shadow is called the fundamental plane, and is taken as the xy -plane of a system of geocentric rectangular coordinates. The x -axis is the intersection of the fundamental plane with the plane of the equator, and is directed positively toward the east; the y -axis is directed positively toward the north. The z -axis is parallel to the axis of the shadow, and is positive toward the Moon. The tabular x and y are the coordinates of the intersection of the axis of the shadow with the fundamental plane, in units of the equatorial radius of the Earth. The declination d and ephemeris hour angle μ of the point on the celestial sphere toward which the axis of the shadow is directed represent the direction of the axis.

The radius of the penumbral cone on the fundamental plane is denoted by l_1 ; the radius of the umbral cone is l_2 , and is regarded as positive for an annular eclipse, negative for a total eclipse. The angles f_1 and f_2 are the angles which the elements of the penumbral and the umbral cones, respectively, make with the axis of the shadow.

To predict accurate local circumstances, calculate the geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ from the geodetic latitude ϕ and longitude λ , with Table VII; the inclusion of the elevation above sea level in this calculation is all that is necessary to obtain the local circumstances at high altitudes or in the ionosphere. Obtain approximate times for the beginning, middle, and end of the eclipse from the eclipse map; and for each of these three times, take from the table of Besselian elements the values of x , y , $\sin d$, $\cos d$, μ ,

and l_1 , except that for the middle l_2 is needed instead of l_1 where the eclipse is total or annular. The hourly variations x' , y' , of x and y are needed, and may be obtained with sufficient accuracy by multiplying the first differences of the tabular values by 6.

For each of the three approximate times, calculate the coordinates ξ , η , ζ of the observer, and the hourly variations ξ' , η' , from

$$\begin{aligned}\xi &= \rho \cos \phi' \sin h, \\ \eta &= \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos h, \\ \zeta &= \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos h, \\ \xi' &= \mu' \rho \cos \phi' \cos h, \\ \eta' &= \mu' \xi \sin d - \zeta d',\end{aligned}$$

where

$$h = \mu - \lambda - 1.0027 \Delta T.$$

Next, calculate

$$\begin{aligned}u &= x - \xi, & u' &= x' - \xi', \\ v &= y - \eta, & v' &= y' - \eta', \\ L &= l - \zeta \tan f, & n^2 &= u'^2 + v'^2, & (n > 0) \\ \Delta &= \frac{1}{n} (uv' - u'v), & D &= uu' + vv', \\ \sin \psi &= \frac{\Delta}{L}.\end{aligned}$$

Neglecting the variation of L , the correction τ to the assumed time of middle to obtain the *Ephemeris Time of greatest phase* is

$$\tau = -\frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

The correction τ to the assumed times of beginning, middle and end to obtain the *Ephemeris Times of contacts* is

$$\tau = \frac{L}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

The ambiguity in the quadrant of ψ is removed by noting that $\cos \psi$ must be negative for the beginning of the eclipse, for the beginning of the annular phase, and for the end of the total phase, and that $\cos \psi$ must be positive for the end of the eclipse, the end of the annular phase and the beginning of the total phase.

If the eclipse is partial at the place, the quantities l_2 , L_2 and $\sin \psi$ will not be needed for the time of middle.

For greater accuracy, the times resulting from the calculation outlined above should be taken in place of the original approximate times, and a second approximation performed.

The adopted value of ΔT must be subtracted from the final times to obtain the Universal Times of contacts and greatest phase.

The *magnitude of greatest partial eclipse*, in units of the solar diameter, is

$$M_1 = \frac{L_1 - \Delta}{2L_1 - 0.5464},$$

where the absolute value of Δ is used.

The *magnitude of the central phase*, in the same units, is

$$M_2 = \frac{0.5464}{2L_1 - 0.5464}.$$

In order to obtain the *position angle of a point of contact*, calculate the angle N defined by

$$\cot N = \frac{v'}{u'},$$

$\sin N$ having the same algebraic sign as u' . The position angle P of the point of contact, reckoned from the north point of the solar limb toward the east, is

$$P = N + \psi,$$

where the results of the final approximation are used.

The position angle V of the point of contact, reckoned from the vertex of the solar limb toward the east is

$$V = P - C,$$

where C , the parallax angle, is obtained with sufficient accuracy from

$$\tan C = \frac{\xi}{\eta},$$

$\sin C$ having the same algebraic sign as ξ , and the results of the final approximation again being used.

At any locality within several miles of a point for which the preceding computation has been made, the Ephemeris Times of the phases may be obtained by computing differential corrections in which most of the necessary numerical quantities are already available from the previous calculations. Examples illustrating the calculation of the local circumstances of partial, total, and annular eclipses, and the calculation of differential corrections, are given in the *Explanatory Supplement*.

Ephemerides for Physical Observations

The ephemerides for physical observations of the Sun, Moon, and planets are based on the fundamental ephemerides in the preceding part of the volume, and on the additional data to which specific references are made. The tabular values are affected by aberration, and should therefore be interpolated to the actual time of observation; but they are strictly geocentric. They are given to a degree of accuracy sufficient for the reduction of observations; any significant approximations made in their calculation are stated.

The value of the light-time for unit distance used in calculating the physical ephemerides is 498^s.58, corresponding to the adopted values of the solar parallax and velocity of light. The stellar magnitudes of the planets are obtained from the formulae of G. MÜLLER, *Publicationen des Astrophysikalischen Observatoriums zu Potsdam*, 8, 366, 1893; the diameters of the planets are calculated from the same semidiameters at unit distance as in the fundamental ephemerides.

Ephemeris for Physical Observations of the Sun (Pages 300–305)

This ephemeris is calculated from the elements determined by CARRINGTON, *Observations of the Spots on the Sun*, 1863, pages 221, 244:

Inclination of the solar equator to the ecliptic, $7^{\circ} 15'$;

Longitude of the ascending node of the solar equator on the ecliptic,
 $73^{\circ} 40' + 50''.25 t$, where t is the time in years reckoned from 1850;

Sidereal period of rotation, 25.38 mean solar days.

In the ephemeris, P denotes the position angle of the northern extremity of the axis of rotation, measured eastward from the north point of the disk; B_0 , the heliographic latitude, and L_0 , the heliographic longitude, of the central point of the disk. Heliographic longitudes on the surface of the Sun are measured from the solar meridian that passed through the ascending node of the solar equator on the ecliptic on 1854 January 1, Greenwich mean noon (J. D. 239 8220.0); they are reckoned from 0° to 360° , in the direction of rotation, i. e., westward on the apparent disk as viewed on the celestial sphere. CARRINGTON's zero meridian passed the ascending node twelve hours earlier.

The synodic period of rotation is the interval of time during which L_0 decreases by 360° . The mean synodic period is $27^d 2753$. The beginning of each synodic rotation is the instant at which L_0 passes through 0° ; the rotations are numbered in continuation of CARRINGTON's Greenwich photo-heliographic series, of which No. 1 commenced on 1853 November 9.

In computing the physical ephemeris of the Sun, no allowance for the secular motion of the ecliptic is made in the values of the elements; and the latitude of the Sun is neglected. No correction is applied to L_0 for rotation during the light-time, since presumably it is already included in CARRINGTON's meridian; CARRINGTON, in reducing his observations, added $20''$ for aberration to the tabular longitude of the Sun taken from the *Nautical Almanac*, but he appears to have referred his measurements to the *apparent* central point of the disk. By using the apparent longitude of the Sun in calculating the physical ephemeris, the aberration in longitude is included. No further correction for aberration is required.

Ephemeris for Physical Observations of the Moon (Pages 306–313)

In the computation of this ephemeris, the formulae and constants for the physical librations, and the value $1^{\circ} 32'.1$ for the inclination of the mean lunar equator to the ecliptic, that were determined by HAYN, *Abh. d. Math.-phys. Kl. d. K. Sächs. Ges. d. Wiss.*, XXX, page 49, 1907, have been used. The ephemeris is calculated from the apparent coordinates of the Moon and the Sun, and therefore aberration is fully included, excepting the inappreciable difference between the light-time from the Sun to the Moon and from the Sun to the Earth.

The *Age* is the number of days elapsed since the previous New Moon. The *Fraction Illuminated* is the fraction of the area of the lunar disk that is illuminated, and is equal to the illuminated fraction of the diameter perpendicular to the line of cusps.

On the surface of the Moon, selenographic longitudes are measured from the lunar meridian that passes through the mean central point of the visible disk, positive in the direction towards *Mare Crisium*, i. e., towards the west on the celestial sphere. Selenographic latitudes are reckoned positive towards the north limb; that is, they are positive in the hemisphere containing *Mare Serenitatis*. The mean central point of the disk is defined as the point on the lunar surface where the surface is intersected by the radius of the Moon that would be directed towards the center of the Earth, were the Moon to be at the mean ascending node when the node coincided with either the mean perigee or mean apogee.

The tabular selenographic longitude and latitude of the Earth are the geocentric selenographic coordinates of the apparent central point of the disk; at this point on the surface of the Moon, the Earth is in the selenocentric zenith. These coordinates are the sums of the geocentric optical and physical librations in longitude and latitude respectively. When the libration in longitude, or selenographic longitude of the Earth, is positive, the mean central point of the disk is displaced eastward on the celestial sphere, exposing to view a region on the west limb. When the libration in latitude, or selenographic latitude of the Earth, is positive, the mean central point of the disk is displaced towards the south, and a region on the north limb is exposed to view.

The selenographic coordinates of the point on the lunar surface where the Sun is in the selenocentric zenith are the selenographic longitude and latitude of the Sun. Subtracting the selenographic longitude of the Sun from 90° or 450° gives the selenographic *colongitude* of the Sun tabulated in the ephemeris; numerically, it is the *east* selenographic longitude of the morning terminator, and is therefore approximately 270° , 0° , 90° , and 180° at New Moon, First Quarter, Full Moon and Last Quarter, respectively. The longitude of the evening terminator differs by 180° from that of the morning terminator.

The position angle of the axis is the angle that the lunar meridian through the apparent central point of the disk towards the north lunar pole forms with the declination circle through the central point, reckoned eastward from the north point of the disk.

The column headed *Position Angle—Bright Limb* contains the position angles of the midpoint of the illuminated limb, reckoned eastward from the north point of the disk. The position angle of the terminator, defined as the position angle of the northern cusp, always lies between -90° and $+90^\circ$; before Full Moon it is 90° greater, after Full Moon 90° less, than the position angle of the midpoint of the bright limb.

For precise reductions of observations, the tabular librations and position angles of the axis should be reduced to topocentric values. For this purpose, the following differential corrections may be used (ATKINSON, *Mon. Not. Roy. Astr. Soc.*, **111**, 448, 1951). The geocentric zenith distance of the Moon, z , the parallactic angle Q , and the topocentric parallax π' are calculated from the geocentric right ascension, declination, and parallax of the Moon, the latitude ϕ of the observer, and the local sidereal time, with the following formulae,

where h is the local hour angle of the Moon and either of the two formulæ for Q may be used:

$$\begin{aligned}\cos z &= \sin \phi \sin \delta + \cos \phi \cos \delta \cos h, \\ \sin Q &= \sin h \cos \phi \operatorname{cosec} z, \\ \cos Q &= \frac{\sin \phi - \cos z \sin \delta}{\sin z \cos \delta}, \\ \pi' &= \pi (\sin z + 0.0084 \sin 2z).\end{aligned}$$

The corrections to the tabular selenographic longitude l and latitude b of the Earth and the position angle C of the axis are

$$\begin{aligned}\Delta l &= -\pi' \sin (Q - C) \sec b, \\ \Delta b &= +\pi' \cos (Q - C), \\ \Delta C &= +\sin (b + \Delta b) \Delta l - \pi' \sin Q \tan \delta.\end{aligned}$$

The tabular values should be interpolated to the time of observation with second differences.

Disks of Mercury and Venus (Pages 314–315)

The phase, k , is the ratio of the area of the illuminated portion of the apparent disk to the area of the entire apparent disk regarded as circular.

The phase angle, i , is the planetocentric angle between the Sun and the Earth.

The angle Θ is the position angle of the midpoint of the bright limb, measured eastward from the north point of the disk.

The quantity L , conventionally called the brilliancy of the disk, is the numerical value of ks^2/r^2 , where r is the radius vector from the Sun to the planet in astronomical units, s is the apparent semidiameter in seconds of arc, and ks^2 is the illuminated area of the apparent disk in units of a circular area $1''$ in apparent semidiameter. To derive the actual brightness or stellar magnitude, L must be modified by an empirical function of the phase angle; L is a measure only of the brightness which, if there were no dependence of apparent albedo on phase angle, would be determined by the area illuminated, and the relative intensity of the incident light per unit area which varies as $1/r^2$.

Ephemerides for Physical Observations of Mars, Jupiter, and Saturn (Pages 316–331)

These ephemerides give the time required for light to travel from the planet to the Earth, and the stellar magnitude and apparent diameter of the planet; and for the illuminated disk they give the position angle of the point of greatest defect of illumination, measured eastward from the north point of the disk, and the angular amount of the defect; the planetocentric angle i between the Sun and the Earth is also tabulated. In the ephemeris for Mars, the ratio k of the area of the illuminated apparent disk to the area of the entire apparent disk regarded as circular is included.

For Mars and Jupiter, quantities are given which determine the geocentric and heliocentric aspects of the planetographic coordinate systems on the surface of the planet, to which the markings on the disk are referred. The aspect

of the disk depends upon the positions of the Earth and the Sun relative to the different areas of the surface of the planet, or equivalently upon the apparent positions of the Earth and the Sun on the planetocentric celestial sphere at the different points of the surface. To represent these positions, coordinate systems are defined on the planetocentric sphere, by the plane of the equator of the planet and the plane of its orbit, in the same way as right ascension and declination, and celestial longitude and latitude, are defined on the geocentric celestial sphere by the equator of the Earth and the ecliptic. Because of the mathematically indefinite radius of the celestial sphere, the same fundamental reference circles are defined on the geocentric sphere as on the planetocentric sphere by the orbital and equatorial planes of the Earth and the other planets.

On a planetocentric sphere, the apparent position of the Earth is diametrically opposite the geocentric position of the planet, and the Sun is opposite the heliocentric position. The planetocentric angular distance of the Earth from the equator of the planet, denoted by D_E and known as the planetocentric declination of the Earth, is numerically equal and opposite in sign to the geocentric angular distance of the planet from the plane of the equator of the planet. The angular distance in the plane of the planetary equator from the ascending node of the orbit of the planet on its equator eastward to the great circle through the Earth and the celestial pole of the planet, denoted by A_E , is known as the planetocentric right ascension of the Earth; it is equal to the geocentric longitude of the planet measured in the plane of its equator from the descending node of its orbit on its equator.

Similarly, the planetocentric right ascension of the Sun, A_S , is equal to the heliocentric longitude of the planet measured in the plane of its equator from the descending node of the orbit; and the planetocentric declination of the Sun, D_S , is numerically equal and opposite in sign to the heliocentric angular distance of the planet from the plane of the planetary equator. The planetocentric longitude of the Sun, denoted by L_S and measured in the plane of the orbit of the planet from the ascending node on its equator, is equal to the heliocentric orbital longitude of the planet reckoned from the descending node; it is tabulated only for Mars.

Planetographic longitudes on the surfaces of Mars and Jupiter are reckoned from 0° to 360° in the direction opposite the rotation, that is, eastward on the celestial sphere. The zero meridian from which the longitudes are measured is defined by the adopted position of the pole and an adopted value for the longitude of the meridian that passes through the central point of the disk at a selected epoch. The adopted longitude of the central meridian at the epoch and the rate of rotation of the planet determine the central meridian at any other time. The rotation is referred to the ascending node of the orbit on the equator of the planet, and the period is therefore known as the sidereal period of rotation; it differs slightly from the actual period of rotation, because of the precession of the axis of the planet.

For Mars, the position of the north pole that is used in computing the physical ephemeris was adopted in 1909, and the zero meridian is defined by

the tabular central meridian at Greenwich mean noon on 1909 January 15; but beginning with 1960, a period of rotation is adopted that differs from the value used before 1960. Consequently, from 1959 to 1960 there is a discontinuity in the tabular longitude of the central meridian, amounting to about -1° . The adopted rotation elements of Mars are:

North pole (LOWELL and CROMMELIN, *Mon. Not. Roy. Astr. Soc.*, **66**, 56, 1905)

At the beginning of the year t ,

$$\alpha_0 = 21^h 11^m 10^s.42 + 1^s.565 (t - 1950.0),$$

$$\delta_0 = +54^\circ 39' 27'' + 12''.60 (t - 1950.0).$$

Sidereal period of rotation (ASHBROOK, *Astr. Jour.*, **58**, 145, 1953)

In Ephemeris Time, $24^h 37^m 22^s.6689$.

Central meridian, referred to the zero meridian of 1909

Longitude of central meridian,

$$1909 \text{ Jan. 15, G.M.N. (J.D. 241 8322.0), } 344^\circ 41'.$$

Daily motion, $350^\circ 891' 962''$.

The tabular central meridian is for the geometric disk, not the illuminated disk; and the time of transit of the zero meridian is for the transit across the central point of the geometric disk.

The position angle of the axis is the angle which the meridian from the central point of the disk to the north pole of rotation forms with the declination circle through the central point, measured eastward from the north point of the disk.

For Jupiter, the adopted position of the pole is derived from the position for 1750 given by DAMOISEAU, *Tables Écliptiques des Satellites de Jupiter* (Paris, 1836), page i; the longitude of the central meridian that defines the zero meridian, and the rate of rotation, are adopted from the ephemeris last published by MARTH, *Mon. Not. Roy. Astr. Soc.*, **56**, 523, 1896:

North Pole of Jupiter

At the beginning of the year t ,

$$\alpha_0 = 17^h 52^m 00^s.84 + 0^s.247 (t - 1910.0),$$

$$\delta_0 = +64^\circ 33' 34''.6 - 0''.60 (t - 1910.0).$$

Sidereal period of rotation

Central meridian

Longitude,

$$1897 \text{ July 14, G. M. N. (J.D. 241 4120.0)}$$

Daily motion

System I	System II
$9^h 50^m 30^s.903$	$9^h 55^m 40^s.632$

$$47^\circ 31'$$

$$877^\circ 90'$$

$$96^\circ 58'$$

$$870^\circ 27'$$

System I applies to all points on or between the north component of the south equatorial belt and the south component of the north equatorial belt; System II applies north of the south component of the north equatorial belt, with some rare exceptions, and south of the north component of the south equatorial belt.

The tabular central meridians are for the geometric disk; applying to them the corrections in the column headed *Correction for Phase* gives the longitudes

of the central meridian of the apparent or illuminated disk. In addition, the longitude of the central meridian of the illuminated disk is tabulated at daily intervals in a separate ephemeris; the tables of the motion of the central meridian accompanying this ephemeris are based on the mean daily synodic rotations during the period when Jupiter is observable, which are $877^{\circ}95$ for System I, and $870^{\circ}30$ for System II. An accuracy of $0^{\circ}.1$ for the central meridian of the illuminated disk is usually sufficient, and may readily be obtained from the daily ephemeris; interpolation in the 4-day ephemeris is less convenient, but may be made in the infrequent cases when an accuracy of $0^{\circ}.01$ is needed.

The ephemeris for physical observations of Jupiter includes the period near conjunction, for the purpose of radio observations.

Satellites

The ephemerides of the satellites are intended only for search and identification, not for the exact comparison of theory with observation; they are calculated only to an order of accuracy sufficient for the purpose of facilitating observations. They are corrected for light-time; the tabular values are directly comparable with observations at the tabular times. The value of the light-time used in calculating the ephemerides of the satellites is $498^{\text{m}}58$ for unit distance. The orbital elements and constants are given in the *Explanatory Supplement*.

The apparent orbit of a satellite is an ellipse on the celestial sphere, with semimajor axis a/Δ , where a is the apparent semimajor axis at unit distance in seconds of arc and Δ is the geocentric distance of the primary. The value of the eccentricity of the apparent orbit at opposition is used in calculating the tables for finding the position angle p of the satellite relative to the primary, measured from north toward east, and the apparent distance s from the central point of the disk of the primary. The effect of the eccentricity of the actual orbit upon its projection into the apparent orbit, and the variation of the eccentricity of the apparent orbit, are neglected. Approximately, therefore, $s = F(a/\Delta)$, where F is the ratio of s to the apparent distance at greatest elongation; and at the greatest elongations $p = P \pm 90^{\circ}$, where P is the position angle of the extremity of the minor axis of the apparent orbit that is directed toward the pole of the orbit from which the motion appears counterclockwise. With P_0 denoting an arbitrary fixed integral number of degrees near the value of P at opposition, the value of p at any time is expressed in the form $p_1 + p_2$, where p_1 is the sum of the approximate position angle $P_0 + 90^{\circ}$ at elongation and the amount of motion in position angle since elongation, and p_2 denotes the correction $P - P_0$. In the tables of p_1 the tabular entry for argument $0^{\text{h}} 00^{\text{m}}$ is the value of $P_0 + 90^{\circ}$.

The differences of right ascension and declination, in the sense "satellite minus primary", are approximately

$$\Delta\alpha = s \sin p \sec (\delta + \Delta\delta), \quad \Delta\delta = s \cos p,$$

in which $s \sin p$ and $s \cos p$ are the rectangular coordinates of the satellite in the directions perpendicular to the circle of declination and along this circle, respectively.

Satellites of Mars (Pages 332–335)

The ephemerides of the satellites of Mars are computed from the orbital elements given by H. STRUVE, *Sitzungsberichte der Königl. Preuss. Akademie der Wissenschaften*, 1911, page 1073.

Satellites of Jupiter (Pages 336–363)

The ephemerides of Satellites I–IV are based on SAMPSON's *Tables of the Four Great Satellites of Jupiter*, London, 1910; but they are computed in accordance with the procedures developed by H. ANDOYER, *Bulletin Astronomique*, 32, 177, 1915, in which a number of approximations and modifications of the tabular procedures are made.

The elongations of Satellite V are computed from circular orbital elements determined by A. J. J. VAN WOERKOM, *Astr. Pap. Amer. Eph.*, vol. XIII, Part I, 1950, pages 8, 14, 16.

The differential coordinates of Satellites VI and VII are computed from J. BOBONE's tables, *Astronomische Nachrichten*, 6279, 321, 1937, and 6309, 401, 1937.

The actual phenomena of Satellites I–IV are not instantaneous. Since the predicted times are for mid-phenomena, a satellite is usually observable after the given time of EcD and before the time of EcR. In the case of Satellite IV the difference is sometimes quite large. The light curves of the eclipse phenomena are discussed in *Planets and Satellites* (The Solar System, vol. III) ed. Gerard P. Kuiper and Barbara M. Middlehurst, 1961, pages 327–340.

The approximate configurations of Satellites I–IV are shown in graphical form, to facilitate identification, on pages facing the tabular ephemerides of the eclipses and other phenomena of the satellites. The central vertical band in each diagram represents the equatorial diameter of the disk of Jupiter; time is shown by the vertical scale, each horizontal line denoting 0^h U.T., and the relative positions of the satellites at any time with respect to the disk of Jupiter are given by the curves. In constructing these diagrams, the coordinates of the satellites in the direction perpendicular to the equator of Jupiter are necessarily neglected.

For eclipses, the points *d* of immersion into the shadow and points *r* of emersion from the shadow are shown pictorially at the foot of the right-hand page for the superior conjunctions nearest the middle of each month; and at the foot of the left-hand page the rectangular coordinates of these points are given, in units of the equatorial radius of Jupiter. The axis of *x* is parallel to the equator of Jupiter, positive toward the east, and the axis of *y* is positive toward the north pole of Jupiter. The suffix 1 refers to the beginning of an eclipse, the suffix 2 to the end of an eclipse.

Satellites and Rings of Saturn (Pages 364–379)

The ephemeris of the rings of Saturn is computed from the elements of the plane of the rings determined by G. STRUVE, *Veröff. d. Universitätssternwarte zu Berlin-Babelsberg*, VI, 4, page 49, 1930. The apparent outer dimensions of the outer ring are according to H. STRUVE, *Pub. de l'Obs. Central Nicolas*, XI, page

226, 1898; the factors for computing the relative dimensions of the rings are from BESSEL, *Abhandlungen*, I, pages 110, 150, 319, except those for the dusky ring which are based on the observations of various astronomers.

The ephemeris of the rings gives the quantities that determine the Saturnicentric positions of the Earth and the Sun referred to the plane of the rings, upon which the appearance of the rings depends; the tabular quantities are:

- U , the geocentric longitude of Saturn, measured in the plane of the rings eastward from its ascending node on the mean equator of the Earth; the Saturnicentric longitude of the Earth, measured in the same way, is $U+180^\circ$.
- B , the Saturnicentric latitude of the Earth referred to the plane of the rings, positive toward the north; when B is positive, the visible surface of the rings is the northern surface.
- P , the geocentric position angle of the northern semiminor axis of the apparent ellipse of the rings, measured from north toward east.
- U' , the heliocentric longitude of Saturn, measured in the plane of the rings eastward from its ascending node on the ecliptic; the Saturnicentric longitude of the Sun, measured in the same way, is $U'+180^\circ$.
- B' , the Saturnicentric latitude of the Sun referred to the plane of the rings, positive toward the north; when B' is positive, the northern surface of the rings is the illuminated surface.
- P' , the heliocentric position angle of the northern semiminor axis of the rings on the heliocentric celestial sphere, measured eastward from the circle of latitude through Saturn.

The ephemeris of the rings is corrected for light-time.

The ephemerides of the six inner satellites and of Iapetus are computed from the orbital elements determined by G. STRUVE, *Veröff. d. Universitätssternwarte zu Berlin-Babelsberg*, VI, Parts 4 (1930) and 5 (1933). The ephemeris of Hyperion is computed from the elements given by J. WOLTJER, Jr., *Annalen van de Sterrewacht te Leiden*, XVI, Part 3, page 64, 1928; and of Phoebe, from the theory by F. E. ROSS, *Annals of Harvard College Observatory*, LIII, Number VI, 1905.

For the eight inner satellites, the times of conjunctions and elongations, and tables for finding the approximate apparent distance s and position angle p , are given. On the diagram of the orbits of Satellites I-VII, the points of eastern elongation are marked as "0"; and from the tabular times of these elongations, the apparent position of a satellite at any other time may be marked on the diagram by setting off on the orbit the elapsed interval since last eastern elongation. For Hyperion and Iapetus, ephemerides of the differential coordinates are also included; and an ephemeris of differential coordinates is given for Phoebe.

In calculating the elongations and conjunctions, and the tables of apparent distance and position angle, solar perturbations are not included for any of the

eight satellites; and for the five innermost satellites, the orbital eccentricity e is neglected. However, the mean longitude L and mean anomaly M , calculated from accurate values of the orbital elements, and including for Titan the solar perturbations, are tabulated at 10-day intervals for the eight inner satellites, and with them are given the values of the elements that have large variations. From the orbital position of the satellite determined with these tabular values, and the Saturnicentric position of the Earth referred to the orbital plane of the satellite, values for the apparent distance and position angle may be calculated, and differential coordinates in right ascension and declination determined.

The mean orbital longitude L and the true longitude u of the eight inner satellites, and the longitude θ of the ascending node of the orbit on the plane of the rings, are measured from the ascending node of the ring-plane on the mean equator of the Earth; L and u are reckoned along the ring-plane to the node of the orbit, then along the orbit. Prior to 1966, L and u for Hyperion and Iapetus were reckoned from the node of the orbit on the equator of the Earth, and ephemerides were given for U , B , and P referred to the orbital plane. The tabular values of L and M are the geometric values at the tabular times, not corrected for light-time.

The formulae and constants for obtaining the true orbital longitude u and the radius vector r of the eight inner satellites are:

Mimas

$$\begin{aligned} u &= L + 2^{\circ}303 \sin M + 0^{\circ}029 \sin 2M, \\ \frac{r}{a} &= 1.0002 - 0.0201 \cos M - 0.0002 \cos 2M, \\ a &= 255''.9, \quad \sin \gamma = 0.0265. \end{aligned}$$

Enceladus

$$\begin{aligned} u &= L + 0^{\circ}509 \sin M, \\ \frac{r}{a} &= 1 - 0.0044 \cos M, \\ u - \theta &= 36^{\circ} + 263^{\circ}15 \text{ (J.D.} - 243\,6000.5), \\ a &= 328''.3, \quad \sin \gamma = 0.0004. \end{aligned}$$

Tethys

$$\begin{aligned} u &= L, \quad \frac{r}{a} = 1, \\ a &= 406''.4, \quad \sin \gamma = 0.0191. \end{aligned}$$

Dione

$$\begin{aligned} u &= L + 0^{\circ}253 \sin M, \\ \frac{r}{a} &= 1 - 0.0022 \cos M, \\ u - \theta &= 214^{\circ} + 131^{\circ}62 \text{ (J.D.} - 243\,6000.5), \\ a &= 520''.5, \quad \sin \gamma = 0.0004. \end{aligned}$$

Rhea

$a = 726''.9,$	
$e = 0.00086$	June 9—June 12,
$= 0.00085$	June 13—September 2,
$= 0.00084$	September 3—November 24,
$= 0.00083$	November 25—December 36.

Titan

$a = 1684''.4,$	
$e = 0.02885$	June 9—September 21,
$= 0.02884$	September 22—December 36.

Rhea, Titan, Hyperion

$$u = L + 2e \sin M + \dots,$$

$$\frac{r}{a} = 1 + \frac{1}{2}e^2 - e \cos M - \frac{1}{2}e^2 \cos 2M - \dots$$

Iapetus

$a = 4908''.6,$	
$\theta = 255^\circ.45$	June 9—August 7,
$= 255.44$	August 8—November 6,
$= 255.43$	November 7—December 36.
$u = L + 3^\circ.240 \sin M + 0^\circ.057 \sin 2M + 0^\circ.001 \sin 3M,$	
$\frac{r}{a} = 1.0004 - 0.0283 \cos M - 0.0004 \cos 2M.$	

The apparent rectangular coordinates referred to Saturnicentric axes, with the x -axis in the plane of the rings and positive toward the east, the y -axis positive toward the north pole of Saturn, are

$$x = \frac{a}{\Delta} \frac{r}{a} \frac{1}{1 + \zeta} \sin (u - U)$$

$$= s \sin (p - P),$$

$$y = \frac{a}{\Delta} \frac{r}{a} \frac{1}{1 + \zeta} \left[\sin B \cos (u - U) + \cos B \sin \gamma \sin (u - \theta) \right]$$

$$= s \cos (p - P),$$

in which U and B refer to the plane of the rings, and u is measured from the node of the rings on the equator of the Earth to the node of the orbit on the rings, then along the orbit.

Mimas

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9999	360.0
67.3	1.0000	292.7
112.6	1.0001	247.4
247.3		112.7

Enceladus

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9998	360.0
25.9	0.9999	334.1
72.5	1.0000	287.5
107.4	1.0001	252.6
154.0	1.0002	206.0
205.9		154.1

Tethys

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9998	360.0
43.4	0.9999	316.6
75.9	1.0000	284.1
104.0	1.0001	256.0
136.5	1.0002	223.5
223.4		136.6

Dione

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9997	360.0
19.0	0.9998	341.0
55.4	0.9999	304.6
79.1	1.0000	280.9
100.8	1.0001	259.2
124.5	1.0002	235.5
160.9	1.0003	199.1
199.0		161.0

Rhea

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9996	360.0
18.6	0.9997	341.4
47.4	0.9998	312.6
66.0	0.9999	294.0
82.2	1.0000	277.8
97.7	1.0001	262.3
113.9	1.0002	246.1
132.5	1.0003	227.5
161.3	1.0004	198.7
198.6		161.4

Titan

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9991	360.0
6.8	0.9992	353.2
28.8	0.9993	331.2
40.5	0.9994	319.5
50.0	0.9995	310.0
58.2	0.9996	301.8
65.8	0.9997	294.2
73.0	0.9998	287.0
79.9	0.9999	280.1
86.6	1.0000	273.4
93.3	1.0001	266.7
100.0	1.0002	260.0
106.9	1.0003	253.1
114.1	1.0004	245.9
121.7	1.0005	238.3
129.9	1.0006	230.1
139.4	1.0007	220.6
151.1	1.0008	208.9
173.1	1.0009	186.9
186.8		173.2

Hyperion

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0.0	0.9990	360.0
23.7	0.9991	336.3
35.0	0.9992	325.0
43.7	0.9993	316.3
51.2	0.9994	308.8
58.0	0.9995	302.0
64.3	0.9996	295.7
70.3	0.9997	289.7
76.0	0.9998	284.0
81.7	0.9999	278.3
87.2	1.0000	272.8
92.7	1.0001	267.3
98.3	1.0002	261.7
103.9	1.0003	256.1
109.6	1.0004	250.4
115.6	1.0005	244.4
121.9	1.0006	238.1
128.6	1.0007	231.4
136.1	1.0008	223.9
144.8	1.0009	215.2
155.9	1.0010	204.1
180.0		180.0

Iapetus

$u-U$	$\frac{1}{1+\zeta}$	$u-U$
0	0.9975	0 360
10	0.9975	+1 350
20	0.9976	2 340
30	0.9978	3 330
40	0.9981	3 320
50	0.9984	4 310
60	0.9988	4 300
70	0.9992	4 290
80	0.9996	4 280
90	1.0000	4 270
100	1.0004	4 260
110	1.0008	4 250
120	1.0012	4 240
130	1.0016	3 230
140	1.0019	3 220
150	1.0022	2 210
160	1.0024	2 200
170	1.0025	+1 190
180	1.0025	0 180

In critical cases ascend

Satellites of Uranus (Pages 380–382)

The ephemerides of Ariel and Umbriel are computed from the orbital elements determined by NEWCOMB, *Washington Obs. for 1873*, App. I; of Titania and Oberon, from the elements by H. STRUVE, *Abh. d. K. Preuss. Akad. d. Wiss.*, 1912. STRUVE's elements of the plane of the orbits are adopted for all four satellites.

Satellites of Neptune (Page 383)

The ephemeris of Triton is calculated from elements by W. S. EICHELBERGER and ARTHUR NEWTON, *Astr. Pap. Amer. Eph.*, vol. IX, Part III, 1926.

Sunrise, Sunset, and Twilight (Pages 384–391)

The tabular times of sunrise and sunset are the instants when the true geocentric zenith distance of the central point of the disk is $90^{\circ} 50'$. With an adopted value of $34'$ for the horizontal refraction, and $16'$ for the semidiameter, the apparent zenith distance of the upper limb, neglecting parallax, is then 90° , and the limb is apparently on the astronomical horizon. The tabular times of the beginning and end of astronomical twilight are the instants when the true geocentric zenith distance of the central point of the disk is 108° .

The tabular values give the local mean times of the phenomena on the meridian of Greenwich for northern latitudes up to $+60^{\circ}$. No interpolation is usually made for the local times at other longitudes; the error from neglecting the variation with longitude is negligible, amounting to a maximum of 2^m in latitude 60° north. To obtain the local *standard* time or zone time, increase the local time four minutes for each degree of longitude west of the standard meridian, or decrease the local time four minutes for each degree east of the standard meridian.

In a *southern* latitude, the time of sunrise, sunset, or beginning or end of twilight, is obtained for any date by entering the table with the same *numerical value* of the latitude, but for a date about six months earlier or later than the actual date, and applying a small correction to the tabular time; these dates and corrections are tabulated at the foot of the page. The periods during which twilight lasts all night in southern latitudes may be found by substituting for the northern latitudes the corresponding southern latitudes, and for the dates the corresponding dates taken from the foot of the page.

Example

On 1967 May 5, in latitude -38° , required the times of sunrise, sunset, and beginning and end of twilight. November 7 is the corresponding date, northern latitude, and the correction is $+13^m$.

	Beginning of Twilight		Sunrise		Sunset		End of Twilight	
	h	m	h	m	h	m	h	m
Lat. $+38^{\circ}$, Nov. 7	5	01	6	31	16	56	18	25
Auxiliary table	+13		+13		+13		+13	
<hr/>								
Lat. -38° , Local mean time, May 5 . .	5	14	6	44	17	09	18	38

The tabular values are based on the “Tables of Sunrise, Sunset, and Twilight” published as a *Supplement to the American Ephemeris for 1946*. These

tables provide for obtaining the times at any point on the Earth in any year of the twentieth century.

Moonrise and Moonset (Pages 392-423)

The tabular times of moonrise and moonset are the instants when the true geocentric zenith distance of the central point of the disk is $90^\circ 34' + s - \pi$, where s is the semidiameter and π the horizontal parallax of the Moon, and $34'$ is the adopted horizontal refraction; the upper limb is then apparently on the astronomical horizon. No allowance is made for the phase of the Moon.

The tabular times are for the meridian of Greenwich, and are given both for northern and for southern latitudes from $+60^\circ$ to -60° . To obtain the local mean time of moonrise or moonset at other longitudes that are 12 hours or less west from Greenwich, take out the tabular times for the given date and for the next following date; at longitudes 12 hours or less east from Greenwich, take out the times for the given date and for the date preceding. Subtract the time on the earlier date from the time on the later date; multiply the difference by the twenty-fourth part of the longitude in hours and decimals of an hour, positive if west, negative if east; apply the product as a correction to the tabular time on the given date to obtain the required local mean time. To obtain the standard time or zone time, increase the local time by four minutes for each degree of longitude west of the standard meridian, or decrease the local time by four minutes for each degree east of the standard meridian.

Examples

1. For 1967 January 21, find the standard time of moonrise and moonset at longitude 145° or $9^h 40^m$ east from Greenwich (20^m west of the standard meridian) and latitude $27^\circ 50'$ south.

	d	Moonrise h m	Moonset h m
For Lat. $-27^\circ 8'$	Jan. 20	13 50	0 10
	Jan. 21	14 48	0 45
Difference		+58	+35
Product of diff. by $-9.7/24$		-23	-14
Local mean time.	Jan. 21	14 25	0 31
Reduction to standard time.		+20	+20
Standard time.	Jan. 21	14 45	0 51

2. For 1967 July 10, find the Eastern Standard Time of moonrise and moonset at Washington, D.C., longitude 77° or $5^h 08^m$ west, latitude $38^\circ 55'$ north.

	d	Moonrise h m	Moonset h m
For Lat. $+38^\circ 9'$	July 10	7 22	21 51
	July 11	8 35	22 20
Difference		+73	+29
Product of diff. by $+5.1/24$		+15	+ 6
Local mean time.	July 10	7 37	21 57
Reduction to standard time.		+ 8	+ 8
Eastern Standard Time	July 10	7 45	22 05

Astronomical Observatories (Pages 424-444)

The list of optical observatories is followed by a list of radio observatories; and an *Index List* is given for finding observatories that are better known by special names than by their geographic location.

The latitudes in most cases are astronomical; but in some instances they have been determined by geodetic triangulation from other points. The geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ are calculated for the International Ellipsoid; the altitude is included in every case where it is known.

The last two columns on the right-hand pages contain the parallax constants

$$\begin{aligned}\Delta_{xy} &= -\rho \cos \phi' \sin 8''.80 \\ &= -426.64 \rho \cos \phi' \times 10^{-7}, \\ \Delta Z &= -\rho \sin \phi' \sin 8''.80 \\ &= -426.64 \rho \sin \phi' \times 10^{-7};\end{aligned}$$

the tabular values are in units of the seventh decimal. Formulae for parallax corrections in right ascension and declination, and for corrections to the equatorial rectangular coordinates of the Sun to eliminate parallax, are given at the foot of each right-hand page.

Tables (Pages 445-473)

A list of the individual tables is given in the *Contents*.

Table I of Julian Day Numbers is explained in the section on the calendar.

Table II, for determining latitude and azimuth from observations of Polaris, includes the precepts for the use of the table at the foot of each page.

Table III, for the reduction of mean places from one epoch to another, is explained in the section on mean places of stars. Tables IV-VI relating to reductions for precession, nutation, and differential aberration, include precepts for their use, and are referred to in the section on Day Numbers.

The precepts for using Table VII to calculate geocentric coordinates are given below the table.

Tables VIII-XII for conversions of measures of time, and the Interpolation Tables XIII-XVII are self-explanatory.

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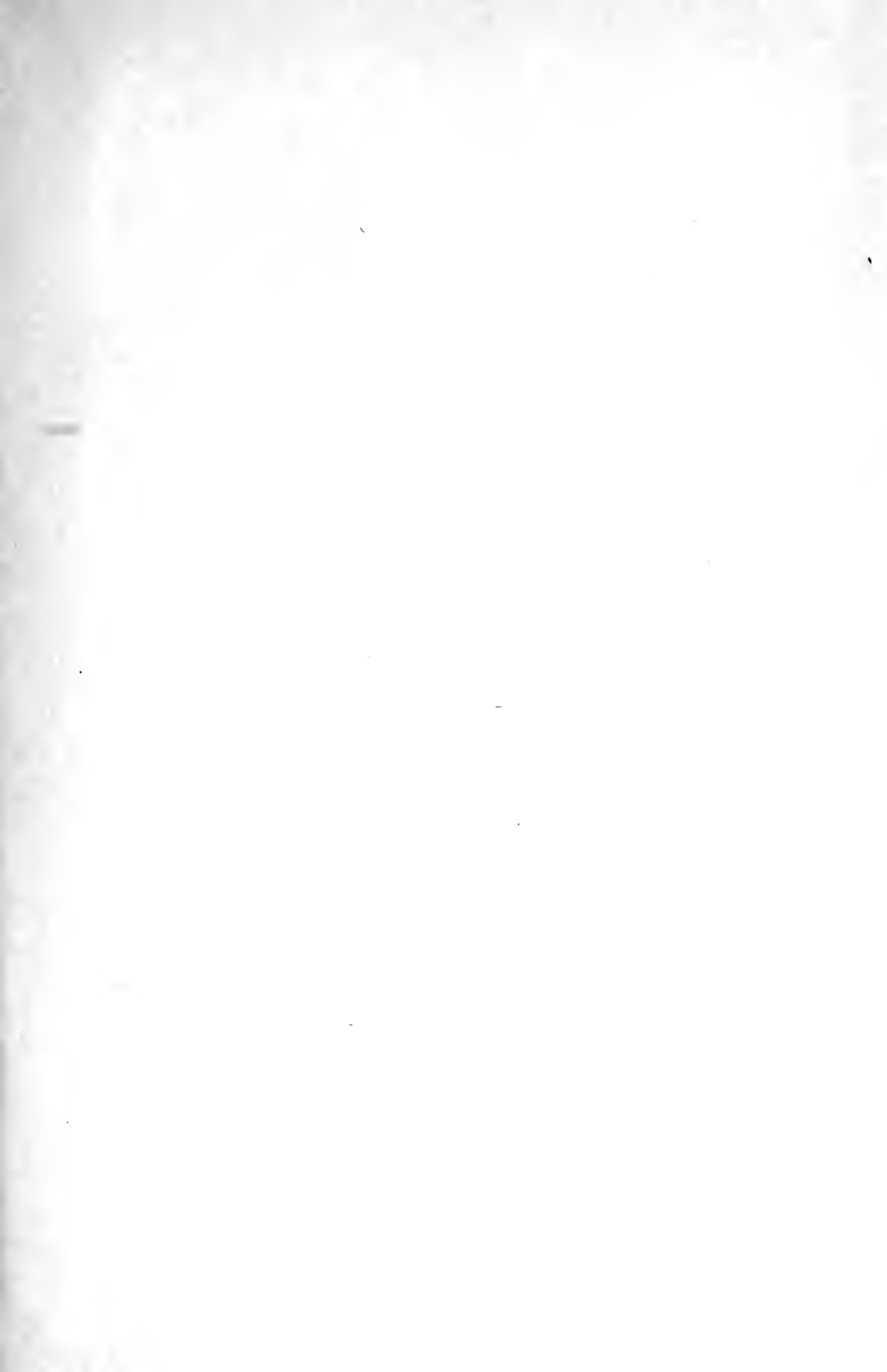
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